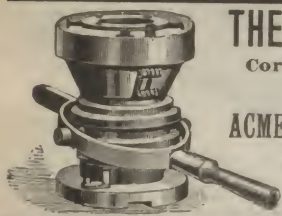


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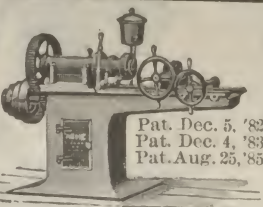
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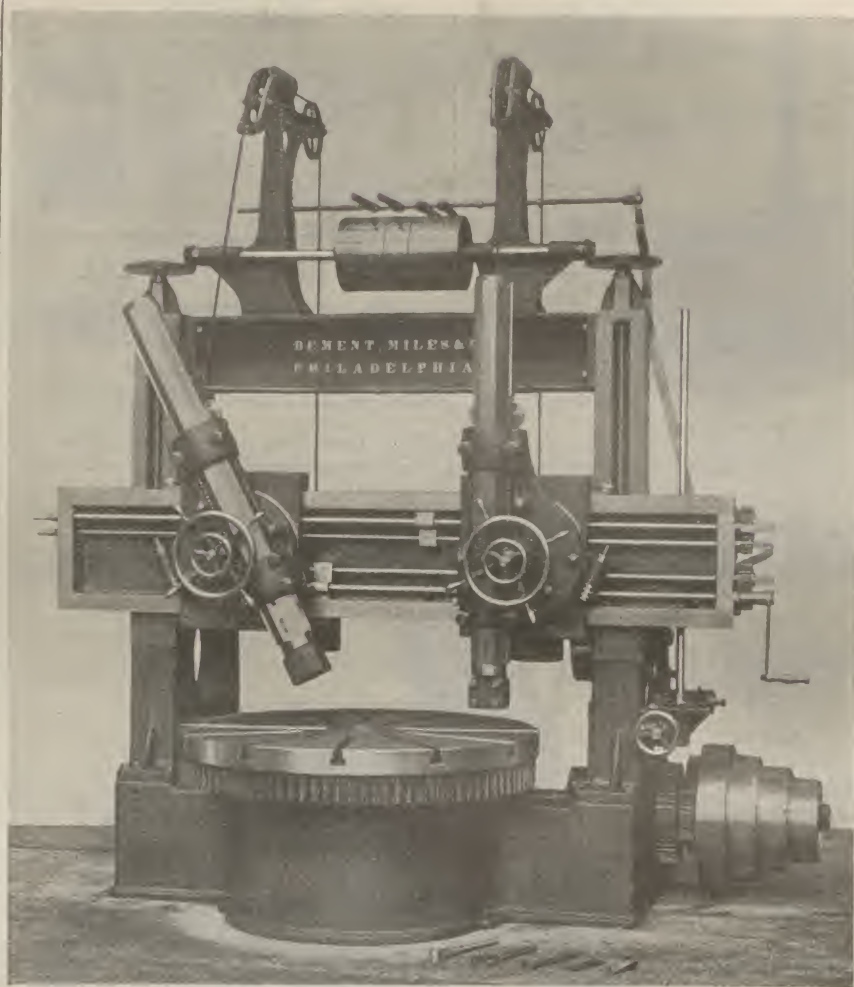
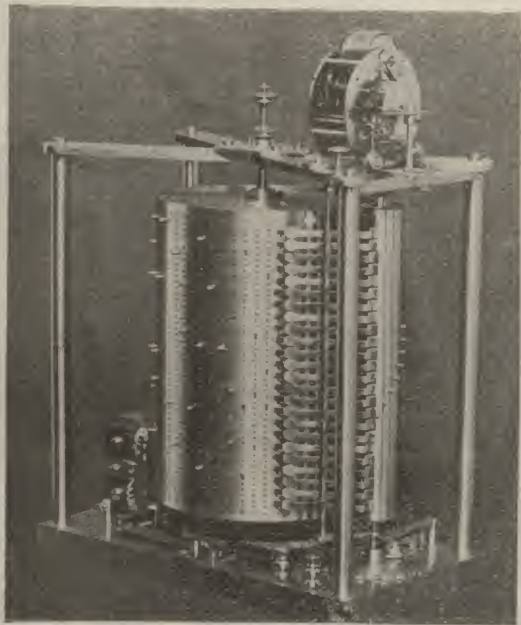
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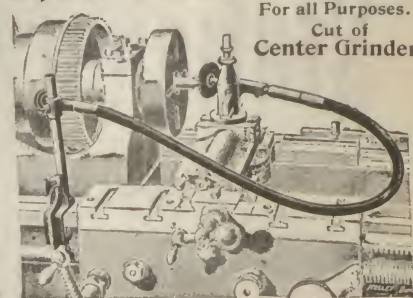
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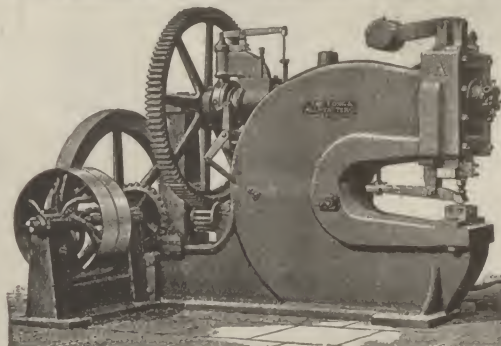
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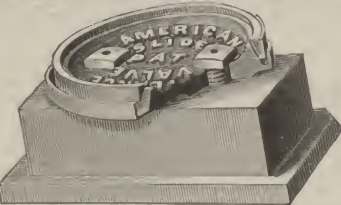
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THE RAILWAY REVIEW

XXXVI.

FEBRUARY 15, 1896.

No. 7.

METHODS OF CLOSING CRACKS IN CAST-IRON.—Many methods for closing cracks or pores in cast iron have been devised, according to Industries and Iron. Chemical or other products, such as sal amoniak, urine, are often used to cause the formation of an iron salt, easily oxidizable, which in a short time gives a certain quantity of hydrated oxide of iron. This is made use of very often to stop up leaks which develop in metallic cylinder. This method is, however, a somewhat lengthy one, several days being oftentimes necessary to obtain satisfactory results; that is to say, entire absence from leakage. A method of closing cracks or pores in a more rapid and certain manner has lately been devised by M. A. Demalight, of Brussels. The method is described as follows: The cylinder is filled with a certain quantity of perchloride of iron. The liquid is then compressed until globules appear on the external surface. The cylinder is then impregnated with perchloride of iron right through, as regards its thickness. Any perchloride in the cylinder is then emptied out, the cylinder being then wiped until the polished surface is again made brilliant. It is then filled with ammonia at 22 deg. Baume, this also being subjected to compression. The effect of this operation is soon noticeable, the perchloride of iron in the metal becomes transformed under the influence of the ammonia into hydrated oxide of iron, at first somewhat frothy in character, and afterward under the influence of the external pressure, rough and compact. Some hydro-chlorate of ammonia also remains, which will soon afterward react on the iron, which will eventually be converted into an oxide compound, adding itself to the first. The leaks marked at the commencement of the operation will be entirely stopped up as soon as the ammonia commences to move out externally, the whole operation not occupying more than a couple of hours. One advantage of the new process is that leaks are stopped by an independent injection of hydrate of iron, whilst in the many processes at present in use, the result is obtained at the expense of the iron in the cylinder, that is to say, one part has to lose that which another portion gains.

THE LARGEST TUG AFLOAT.—The trial trip of the Philadelphia & Reading Coal and Iron Company's new deep sea tug *Tamaqua*, has been successfully completed. This tug is the largest one afloat, and it looks more like an ocean steamer than a tow boat. It is 171 ft. in length, 29 ft. beam, and 31 ft. over guards, with a depth in the hold of 18½ ft. It was built according to the American Ship Master's rules, but it is above the standard, so that it is stronger than the regular specifications call for. The bow is built for the purpose of going through the ice, and is exceedingly strong. During the trip the tug developed a speed of 15½ knots with the tide, or equal to 12¾ or 13 knots on hour. Her engines are 1,000 horse power. She has a long deck house, which covers the engine and boiler space, which gives all necessary cover for officers. The crew and firemen are in the fore-castle. In the fore and aft compartments tanks are erected, which will hold 31,000 gallons of water. She has space for carrying 280 tons of fuel and consumes from 19 to 20 tons of anthracite coal per day. The engines are of the triple expansion order and are capable of a pressure of 160 lbs. She will pull four barges of 1,500 tons of coal each, which is something that no other tug can do. Her pumping arrangements are superb, besides having a powerful wrecking and duplex fire-pump. It is lighted by electricity, having 2 sets of dynamos, and has a search light of 10,000 candle power. The vessel is heated by steam, is fore and aft rigged, and carries sail sufficient to give speed enough to steer with in case of any breakdown in the engines. In the bow of the boat there is a powerful modern steam and hand windlass, which handles the 12 ton anchor. In the stern is also a modern capstain for working purposes, besides a new and improved steam automatic pulling engine which has a drum carrying 1½ in. steel rope with a length of 250 fathoms. The tug is equipped with the latest improved steam and hand steering engines, working on a powerful quadrant, and has John Hand's patent binnacle and compass, so arranged that all local deviations can be adjusted by patent compensation magnets. The boat will shortly be put in commission.

ROENTGEN'S DISCOVERY APPLIED TO METAL.—From a recent announcement made with regard to the new photography, it appears that the process is likely to supply the solution of a problem which has long engaged the attention of the engineering world—the detection of flaws in metal. Some four or five years ago great expectations were aroused by the announcement of the achievements of Captain De Place's "Seiscophone," but little has been heard of it recently. It would seem, however, that when Professor Roentgen's discovery has been brought to a practical issue, we shall be furnished with a much more satisfactory means for detecting flaws and other defects in metal than any available hitherto.

CALCIC CARBIDE AS MOTOR FUEL.—Dr. Adolph Frank, Charlottenburg, has a paper in the *Journal für Gasbeleuchtung* (1895, No. 43) recommending the direct use of calcium carbide in motors, the gas being liberated as required by means of water, and not carried about in a compressed state in cylinders. He says that both the Bitterfeld and the Neuhausen works have improved their products up to 90 per cent yields, and that a price of 90s. a ton does not now look at all unlikely. The theoretical yield of acetylene is 26 lbs. per 64 lbs. of carbide, and the extra weight, that of the calcium, is a small matter in comparison with the expense and risk of 50 atmosphere cylinders. Curiously enough, the liquefied acetylene obtainable from a quantity of carbide occupies, as nearly as possible, twice the volume of the carbide itself. Dr. Frank says that he and Dr. Weil have found that small mammals remain in air containing 4 per cent of acetylene for

half an hour without any apparent harm. The data arrived at are, for a 1,000 horse power marine engine worked for 600 hours: Coal, at 1.54 lbs. per horse power per hour, 420 tons, occupying a space of 420,430 cubic meters; liquid acetylene, at 0.395 lbs. per horse power per hour (Thering and Slaby), 108 tons, filling cylinders of an aggregate capacity of from 270 to 300 cubic meters, and of sufficient strength to withstand a pressure of 50 atmospheres; carbide of calcium, 90 per cent, or 36.56 per cent of acetylene by weight, total required, 300 tons, occupying 131 cubic meters only. In the last case the whole required protection from damp, etc., would not bring the space occupied up to 150 cubic meters. This is certainly a very remarkable comparison, in view of cases where storage capacity is all important; for the whole of the steam boilers would at the same time disappear; but, of course, in the meantime the price of carbide stands in the way of the practical adoption of acetylene for motor purposes.

STRAIN ON RAILWAY AXLES.—Mr. Thomas Andrews, F. R. S., Mechanical Institute Civil Engineers, of Wortley Iron Works near Sheffield, has been awarded by the Council of the Society of Engineers, London, the "Bessemer Premium" for 1895 for his recent paper on "The Effects of Strain on Railway Axles," and on the "The Minimum Flexion Point in Axles." This research is the outcome of many years' laborious scientific investigation on this important subject, which was undertaken with the desire to ascertain with accuracy some of the causes leading to accidental fractures on railways, with the further object of minimizing these causes in the interests of the public safety. In the course of the paper Mr. Andrews said that he had made an extensive series of experiments on various points in connection with axles. Briefly, all the experiments coincided in indicating an increase of rigidity or brittleness of railway axles under the influence of the different kinds of stress and strain applied, the extent of the increase of rigidity being found to vary according to the nature of the metal, the condition of temperature and the species of the strain. The effects of stress were found to be similar, whether produced by slow flexion, impact shocks, torsional, tensile, or other strain. The result also showed that the greater the stress to which the metal was subjected the greater was the increase of rigidity and consequent deterioration of its physical properties. Steel axles, both Bessemer and Siemens, were shown to increase in rigidity and consequent deterioration under concussion shocks more than wrought iron ones. The observance of the fact that a marked increase of resistance to flexion stress was manifested in railway axles at a temperature 100 degrees Centigrade, takes a similar more extensive reduction of flexion endurance at 300 degrees Centigrade was a further important result of the research. This fact afforded a strong indication of the increased danger to railway axles arising from overheated railway axle journals or necks during running.

A NEW MARINE PAINT.—A Scotch inventor is reported to have recently brought to notice a new and valuable marine paint, which is possible of application in a cold state to the submerged and various other parts of ships or other craft, the effect being that of a quick-drying, anti-fouling zinc and tallow paint. For the accomplishment of this purpose a composition has been devised consisting of 40 per cent of oxide of zinc, 12 per cent of linseed oil, 28 per cent of tallow and 20 per cent of thinnings—the latter substance being composed of 60 per cent of shale naphtha, benzoline or other similar spirits—30 per cent of gun damar and 10 per cent of rosin; these proportions are alterable to suit different waters and conditions.

FORGING EYE BOLTS.—There are several ways of making ordinary eye bolt as used in mechanics. Take an order to the country smith, and he will select a piece of iron of the required diameter, scarf one end, bend it back upon itself and weld it there. Then he will open the eye with a drift to the required diameter and pass the finished eye bolt over to you with greater or less imperfections, as the case may happen to be. Take the order to a machine shop, and a solid forge will be got out, the hole fitted, eye drilled and the whole thing nicely finished up, provided no remonstrance is made to the amount of the bill therefore. Take the order to a railroad blacksmith or to any shop employing drop hammers, and the operation will be different. The iron will be upset or doubled upon itself and a weld taken, after which it will be placed in a drop hammer and the eye forged out of the solid end of the rod obtained as above, after which the eye bolt will be placed under a punch which trims both inside and outside of the hole, leaving a perfect and well finished bolt, as strong as the solid one made in the machine shop, and stronger than the one made by the country blacksmith, besides looking three times as well.

MACHINE SHOP METHODS OF 30 YEARS AGO.—Referring to the machine tools at the venerable Soho Foundry, in Birmingham, Eng., the Engineer, of London, says: "The tools are in certain respects unique. They form part and parcel of the place. They have been made where they stand. They are an integral part of the premises. We do not say that they could not be moved; we do not say that they were made without any idea that they would ever have to be moved. At every turn, too, we meet with devices which have been brought out time and again as new, and we feel that master minds have been at work—the minds of men who thought very clearly, who knew exactly what they wanted to do, and then did it in the best manner; and all the while we note that the influence of the millwright made itself felt, and that things were done as mechanical engineers would not do them now, but as they could have been done in Murdoch's day, or not done at all. There are square threaded screws, for example, two inches in diameter, ten or a dozen feet long, four threads to the inch, and these have all been cut with hammer and chisel! What would the average modern fitter think if he was asked to undertake such a job? One of the foremen who has been for more than 30 years at the works told us that he very well remembers seeing some of the old hands cut screws with a chisel, and he was an apprentice when himself taught the art. The bar was supported in a triangular wooden bough, and the screw cut bit by bit to a template. It is easy to see that under these conditions

screws would be used sparingly, at first, at all events. * * In the principal machine shop, one end of which is an erecting shop, are two heavy vertical planing machines. The frames are secured to the wall by stout braces, and the carriage holding the tool travels. The work to be planed is secured on a table at the ground level, and the planing is done on the side next the wall. The system was adopted because very heavy castings were made and had to be handled—castings weighing as much as 9 or 10 tons, and in later years as much as 25 tons, as for example, the oscillating cylinders of the Irish channel mail boats. There were no planing machines that would carry such a load, and even if there were, it was thought much more economical of power to drive the tool along the work than to drive the work under the tool; and in the present day it is beginning to be found out that the moving tool is more economical than the moving casting. The principle has long been employed in plate edge planing machines."

CORROSION OF ALUMINUM.—Herr Donath, according to the *Gas World*, says that aluminum is not at all attacked by boiling distilled water free from air, but that it is distinctly attacked by ordinary boiling water. Gypsum in the water renders it harmless, but chlorides, and especially nitrates, make it attack the aluminum. Fat or carbolic acid have no effect by themselves; but with ordinary water, boiling seems to make these attack the aluminum. How about our new aluminum kettles if this be the case? Herr Zmerzliker confirms these results, and says that hydrogen is given off.

SLAG FOR CEMENT.—In an article published in *LaRevue Technique*, M. Paul Sarrey states that a good slag for making cement should contain from 20 to 25 per cent of alumina, 30 to 35 per cent of silica and 40 to 45 per cent of lime. The hotter the blast furnace the better the slag for the purpose of cement making. On leaving the furnace the slag should be cooled as quickly as possible. Only slag which has been very highly heated is valuable, all other must be rejected. The suitability of a slag for the purpose in question can be judged by the eye after a little practice. After granulation the slag sand should be thoroughly dried, which is usually done by artificial heat, the temperature being raised to a white heat in the process. This done, the slag is ready for grinding, after which it is mixed with a suitable proportion of lime and is ready for use. In subaqueous work this cement gives excellent results, but for work in the open cracking will occur unless it is kept thoroughly wet till hardened.

BRAZING.—Fewer failures in brazing would result if the workman would learn to regard brazing as a sort of gluing operation. Many of the same conditions prevail in both kinds of work. In each the parts to be united must be clean, free from grease and other foreign substances. Above all, make sure that the surfaces to be united are in contact with each other. Of course, speaking in a strictly mechanical sense, it is impossible to place the parts really or actually in mechanical contact with each other. If this could be done there would be no need of brazing, for the surfaces would unite of their own accord when brought in actual contact with each other. That is exactly what happens, says a writer in an exchange, when welding takes place. The heating and the hammering only assist in the two parts together. The softer cement glue, or solder adheres to both the surfaces to be united and holds bringing the molecules of the surfaces in actual contact with each other. When this is done, cohesion steps in and does the rest. In brazing, soldering and gluing cohesion has nothing to do with the matter. Adhesion is what holds them together to the limit of its (the cement or solder) strength. It is almost always the case that the adhesive material is not as strong as the other substances; the joint becomes the weakest place in the united body, hence close fitting of the parts will cause the work to be stronger and more durable.

MOLECULAR CHANGES IN IRON AND STEEL.—We should like to know says the *Age of Steel* what is going on month after month in a hardened steel armor piercing projectile which frequently leads finally to a violent disruptive explosion of the mass, and also what causes a sword to lose temper by lapse of time, while the edge becomes sharper. Why, again, should the tough and flawless bar iron suspension links, which had carried the Hammersmith bridge successfully for over 60 years, snap in two by the dozen during simple transport to Edinburgh, although in every case the halves of the broken links or being thrown down 300 ft. from the top of the Forth bridge on to the rocks below bent like a corkscrew with fracture. Practical engineers have been aware for 40 years past from Fairbairn's experiments that at temperatures of 60 degrees and 320 degrees the strength of wrought iron was practically constant, while at 30 degrees, the strength was slightly increased; but until Prof. Dewar's recent researches they could never have conceived that when immersed in liquid air at a temperature of 320 degrees the strength of iron wire would be raised from 34 tons to 62 tons per square inch. The chemical constituents of iron and steel do not change, but the molecular arrangement and inter-crystalline cohesion must change, and it is to mathematical investigation and laboratory work rather than to practical engineering that we must look for an elucidation of the process.—Sir Benjamin Baker.

DANGERS ATTENDING THE USE OF ACETYLENE GAS.—Dangers in the use of compressed acetylene gas have been discussed in a lecture by Prof. James M. Crafts of the Massachusetts Institute of Technology, before the Society of Arts in Boston. If stored in a steel cylinder of 600 to 700 lbs. pressure, in the event of a fire in the building containing it it would be decomposed into carbon and hydrogen, and the latter would have a pressure of 20,000 lbs. per sq. in., which would burst the cylinder and cause great damage. A slight leak in the cylinder would be still more dangerous. Three or four per cent of the gas in the air would cause a mixture of terrible explosive force. Acetylene gas alone can be exploded by fulminate of silver, and the copper salts of the gas are also violently explosive. One danger in keeping gas in tanks in houses would be in the formation of a copper salt near the acetylene tank.

The coroner's inquest upon the three victims of the acetylene tank explosion which took place in New Haven, Conn., on Jan. 21, resulted in a finding that the explosion was due to the rupture of a valve, causing gas to escape from the tank, and the ignition of the mixed gas and air. The valve was ruptured by the machinist using a 30 in. wrench upon it.

ORIENTAL RAILWAYS.

BY CLEMENT F. STREET.

The all important railway engineering feature of India is the question of the sleeper, or railway tie. I do not know what the Indian engineers would do to pass away the time if it was not for this tie, for I never knew of two of them getting together without having a discussion on the subject. One man will declare to you that the only proper tie to use is the peapod sleeper (what we call the pressed steel tie) and another will declare the cast iron pot sleeper to be the best, and still another will say neither of them is good, and that wood is the only proper material to use. As far as I was able to gather, however, the consensus of opinion is that if a good wooden sleeper can be obtained at a cost not greater than 75 cents apiece, it is foolish to use metal of any kind. The government engineer recently wrote a paper, which was copied in this country, in which he condemned the peapod or pressed steel sleeper, but at the time the paper came out the government was building the Muskaf Boulan railway and using this same steel sleeper. It seems rather strange that the engineer should take the stand he does and at the same time the sleeper he condemns should go into the railways of the government. At the present time the cast iron pot sleeper is used more than the pressed steel, but advocates of the latter are making a hard fight to have it more widely introduced. I hope in the near future to be able to present to the society a paper on the subject of metal ties in which I will be able to treat this subject more fully.

Returning to Calcutta we took a steamer for Rangoon, Burmah, and there took the Burmese State Railway and went north as far as Mandalay. The line passes through a succession of paddy fields and swamps, and while there are no engineering features of note on the line, the engineers surely performed a remarkable feat by remaining in the country long enough to build the line—that is, if the sample of heat given us was representative. At Amarapura the railway operates a very efficient ferry, for transferring goods cars across the Irrawaddy. The banks of the river are 40 or 50 ft. high, and down these the tracks are laid on a gradual slope. The lower end of the tracks is connected by means of a girder to a barge which is firmly anchored out in the stream a short distance. At the upper end of the slope a winding engine is placed and the cars are attached, one at a time, to a wire rope and lowered down the track across the girder and barge to the transfer barge which is moored alongside. The transfer barge when loaded is towed across the river by a steamer which also does duty as a passenger transfer, as the passenger cars are not taken across the river.

One of the great sights of Rangoon is the elephants working in the saw mills and lumber yards. They were formerly employed in all the large mills but at present only one continues to use them, and at this yard we saw 14 at work at every kind of work, from sweeping the floor to piling up timbers which were said to weigh one ton. You can by looking at Harper's Weekly of December, see some photographs I took of these elephants, which will give you a much better idea of the manner in which large timbers are handled than I can give by description. The photographs are said to be taken by Mr. W. H. Jackson, but that is an error—typographical, I suppose.

We saw an elephant walk up to a stick of timber about 14 in. square, 25 to 30 ft. long, which they said weighed one ton, get down on his knees, run his tusks under it, throw his trunk over it, get up and carry it to a pile of similar sticks and put it down with one end resting on the pile and the other end on the ground. He then walked around to the end on the ground, curled up the end of his trunk and with it pushed the timber up on top of the pile and then went to the other end and pushed it up so it lay even with the other timbers.

From Rangoon we went to Singapore, and then up to Bangkok, Siam, where the king is building a railway about 160 miles in length. We were there during March, 1895, and at that time work was progressing rapidly at a number of points, in both the difficult hill section and on the plain. About 30 miles of the main line was completed and we were taken over it by Herr Bethge, director general of railways.

From Bangkok we went back to Singapore and took a steamer from there for Java, and the little island of Java, which looks like a mere speck on most of our maps, is about 800 miles long, 200 miles wide, and has over 23,000,000 inhabitants.

There is in operation about 1,500 miles of railway, most of which is owned and operated by the government, and is 3 ft. 6 in. gage. There is a continuous line from end to end of the island, with a break of gage near the center, where there is a section of 4 ft. 8½ in. gage about 20 or 30 miles or length. The

track is kept in excellent condition and would be a credit to any country. The ballast is gravel and broken stone. About 12 in. outside of each end of the ties a nice little rip-rap wall is built up to a height of 8 or 10 in., which holds the ballast in place and presents a very neat appearance. The ties are completely covered with ballast, excepting one at the center of each rail, which is left open for drainage. Outside the track on each side the sod is kept in perfect condition over the entire right of way of the railway. This sod is mown by the natives in a peculiar fashion. The implement used is a sickle about the shape, but smaller than commonly used in this country for clipping grass, but is fastened to the end of a broomstick, and the operator stands perfectly straight, and as he moves slowly along swings this implement around his head, and every time he strikes the grass it clears off a space of about 6 or 8 in. in diameter. The result is a lawn mown as perfectly as though done with a modern lawn mower. The bridges are all very good and come out from Europe, together with the capstones for the foundations, there being very little stone in the country that is of sufficiently good quality for that purpose. The piers are built of concrete, mixed with Portland cement, and whitewashed so that they make a very handsome appearance. The Dutchmen rule Java with an iron hand. While I was in the office of one of the station masters of the railway, messengers would come in to deliver notes. When the messenger reached the officer's desk he would fall on his knees, place his hands before him in a very abject attitude, slip the message into the hands of the station master or on top of the desk, and then back off and go out of the room as quickly as possible.

From Java we took a steamer to West Australia and there found the railway mostly belongs to the government, is 3 ft. 6 in. gage, and about 300 miles in length: but as there are only about 40,000 people in the colony, you can imagine it is not a very important affair. At Fremantle a very interesting piece of engineering work is under way in the construction of a harbor and the cutting through of a ledge of rock which prevents vessels of deep draft from entering the Swan river. The river is deep and after the ledge is removed ocean steamers will be able to go all the way up to Perth, a distance of some 14 miles. The work is all done under water, the drilling being done entirely by hand from staging. The blasting is done by dynamite, and the spoil removed by English endless chain dredges. The engineers in charge state that the entire cost of drilling, blasting, dredging and dumping the spoil into the sea is less than 75 cents per cubic yard.

The new railway station at Perth is a very nice looking and well arranged building, just completed.

From West Australia we took a steamer to Adelaide and visited the colonies of South Australia, Victoria, New South Wales, Queensland, New Zealand and Tasmania. It is out of the question for me in this talk to give a complete description of the railways in all these colonies and I will give you some of the most important characteristics. The most important and perplexing question from every standpoint is that of the gage of track. In South Australia they have two gages—5 ft. 3 in. and 3 ft. 6 in. In Victoria they have a 5 ft. 3 in. gage and in New South Wales 4 ft. 8½ in. A through service is maintained between Melbourne and Sydney, a part of the distance being over a 5 ft. 3 in. gage and the remainder over a 4 ft. 8½ in., all the business being transferred. This gage question furnishes material for the fertile brain of the inventive crank, and inventions on this line are as numerous in Australia as they are on couplers in this country. The best railway we saw in all our travels was the New South Wales government railway. The main line has a complete interlocking plant at every station and the system of signaling is so complete that it would seem impossible to have accidents. The cars are, most of them, of the American type, and Pullman sleepers are run on the main lines. The engines are mostly of the English type, although some have been sent from this country.

Another serious question in all of Australasia is that of the labor organizations. The labor party is of sufficient power to control legislation and as a result of this and political management none of the roads are paying operating expenses. Advocates of government ownership of railways have in this country an example of the disastrous results which must follow any such control, and no more clinching argument could be advanced against it than a complete showing up of the condition of affairs as they actually exist. In Japan there is about 2,500 miles of railway in operation, of which some 500 miles belong to the government and the remainder to 13 or 14 private companies, having systems ranging from 5 to 600 miles in extent. The largest single system is that of the Nipon railway, which comprises about 600 miles in operation and 200 under construction. The aggregate capital invested constructing 1,879 miles of railway, which was the total miles in operation in December, 1892, is given as 94,163,836 yen, which would be equivalent to a title over \$25,000 per mile. During the year 1892 the number of passengers carried per mile of track was 14,300 and the tons of goods per mile of track was 1,500. The gage of track is universally 3 ft. 6 in.

Many of the lines were constructed and oper-

ated under the supervision of European engineers, but the Nipon Railway is a notable exception to this, as it was built entirely under the supervision of Japanese engineers, by Japanese capital and none but Japanese have ever been connected with its operation and management. The average cost of the railway per mile is only about \$16,750, which speaks wonderfully well of its engineers. From an engineering standpoint the rack railway on the Yokogawa-Karusawa section of the government railway is the most interesting in Japan, and is described by Mr. Francis H. Trevethick in a paper read before the Asiatic Society, of Japan, as follows:

"The question of making the connection between Yokogawa, 1,263 ft., and Karusawa, 3,080 ft. above sea level, has been the cause of much thought and consideration to the railway engineers. Minute surveys over the Usuitoge (pass), an extremely rough portion of the Nakesendo highway, had been made in past years. They resulted in proving that to lay an ordinary railway over the pass would, in the first place, require a large expenditure, and when completed on gradients of 1 in 40, with sharp curves, it would be about 17 miles long. At about this time two young engineers returned after one and one-half year's trip to America and Europe, sent to study railway construction, and they were greatly taken with the Abt rack railway system for passing over rough country. And from this and other circumstances the adoption of the Abt system for this district was decided upon, and fresh surveys of three different routes under this system were begun in April, 1890, they are:

1. *The Wami Route.*—This, the most southern of the three routes, leaves the Karusawa plain by the Wami pass, and proceeds on its downward course by the hamlets of Onga, Akahama and Arai, and enters Yokogawa station. The distance is 7 miles 50 chains, of which 2 miles 64 chains are on a gradient of 1 in 40, and 4 miles 67 chains incline of 1 in 15. Tunnels are 17 in number, with an aggregate length of 183½ chains; or 2 miles 23½ chains.

2. *The Iri-Yama Route.*—This is the central route. It emerges from the Karusawa plain by Mount Manatcho, and skirting around Mount Inamuro proceeds on to Akahama, and thence to Yokogawa with 1 in 40 gradient. Its length would be 7 miles 36 chains, of which 2 miles 64½ chains are on a gradient of 1 in 40 and 4 miles 51½ chains on 1 in 15. The tunnels would be 21 in number, with an aggregate length of 154 chains or 1 mile 74 chains.

3. *The Nakao Route.*—This is the most northerly route. It begins at the Karusawa station and follows the new road (Nakasendo) in the Nakao Valley and joins via Sakamoto the existing railway at Yokogawa. Its length is 6 miles 77½ chains, of which 2 miles 28 chains are on an incline of 1 in 40, and 4 miles 49½ chains on 1 in 15. Tunnels 26 in number, with an aggregate length of 221 chains 88 links, or 2 miles 61½ chains.

"When the results of the preliminary surveys of these alternative lines were compared it was seen that the Wami line, though encumbered by one long tunnel of over 60 chains, had the smallest number of them; that the Iri-Yama line was hampered by numerous curves, and that the Nakao line, by following the main road in close proximity, had an ample means of supplying material. A second survey of the Wami and the Nakao line, the result of which proving satisfactory to the Nakao line, it was finally adopted in February, 1891.

"The line was commenced in March, 1891. It being laid out over a wild district, has necessitated engineering works of no ordinary nature, rocky hills having to be cut away and ravines filled up, extremely steep gradients introduced, as many as 26 different places within this short distance having had to be pierced by tunnels. Thanks to the fact of the line being located along the public roadway, and the latter having thereby afforded ample means of transportation and distribution by means of the horse tramway, no dearth in the supply of material has been experienced at the places where the works were being carried on.

"The experience gained from the practical illustrations of the effects of earthquake phenomena on bridgework during the great earthquake of the Owari and Mino provinces being availed of, some alteration of the designs for the brick arches and piers of the bridges on this railway was necessitated. The principal bridge is over the Usui river; it has four spans of 60 ft., built on brick arches, and it is 110 ft. above the ground. There are 2,200,000 bricks in this structure.

"The construction of this line was begun in March, 1891, and opened for traffic on the 1st of April, 1893. It was therefore completed in 25 months. The principal works connected with this line were: Earthworks, cuttings, embankments, deviation of roads, etc., 89,404 tsubo;* tunnels, 26 in number, with an aggregate length of 14,644 ft.; bridges, 18, with an aggregate length of 1,471 ft.; culverts, 20; rails laid for the main line and the sidings, 8 miles 44 chains; a passing station at Kuma-no-taira, which is half way up the gradient; and other buildings, 651 tsubo.

"Without going into the advisability of an alteration in the general construction of the railway, and whether it is wise or otherwise, to adopt a new sys-

*NOTE.—A tsubo equals 8 cubic yards.

tem from the financial and military point of view, the engineer in charge and his assistants are to be congratulated on the way the works are constructed, of which any country might be proud."

In this account the fact is omitted that the cost of the line as constructed by the Japanese was within the appropriation made for its construction, and was about one-half the amount estimated by English engineers for the line advocated by them. Practically all the railways in Japan are now being operated exclusively by Japanese, and when it is remembered that the first line in the country was opened in 1872, and that only a few years before that date the country was closed to foreigners, it will be seen that the progress of the country is almost magical.

I have endeavored in the foregoing remarks to give you some idea of the railways in the countries visited by the commission up to July 25, when I left it; and in closing I wish to say that each one of these countries has conditions peculiar to itself, which those building and operating the railway lines seem to have in every instance comprehended and met in a greater or less degree; but I am indeed thankful that it is my lot to live in a country where the conditions require a railway service which gives the traveler the most comfortable cars, the fastest and smoothest running trains, the best meals, and in fact luxuries which are not dreamed of in any of the many places in which it has been my pleasure to travel.

ELECTRIC TRACTION ON THE BROOKLYN BRIDGE.

The first official trial of electricity as applied to the switching of the cars on the Brooklyn bridge was made February 8, at 11 a. m., in the presence of the officers in charge of the bridge. The motor car was coupled to three of the ordinary passenger cars and the complete train of four cars was switched by the motors several times from the incoming to the outgoing platforms and thence to the cable sheaves. The car was then taken over the complete bridge circuit twice. Complete satisfaction was expressed by the president and by Chief Engineer C. C. Martin, with the manner in which the work was performed.

The use of electricity in place of steam for switching the cars at the ends of Brooklyn bridge has been recognized as the only suitable method ever since the electric railway motor became a practical success. But not until the motor had been adapted to heavy train service and had proved successful on the Metropolitan West Side Elevated road of Chicago, the Nantasket Beach division of the New York, New Haven & Hartford Railroad and on the Baltimore & Ohio main line, did its employment in the bridge service become possible. Experiment is not a function of a municipal body, such as that governing the operation of the bridge, consequently it hesitated to apply electricity to bridge traction service, until it was certain that if applied it would work without a hitch. The Chicago road has been running without a break of any kind since last June, the Nantasket Beach road was operated during the past summer without the slightest trouble, and the electric locomotives of the Baltimore & Ohio Railroad have been conducting the entire freight service through the tunnel since the second of August last. Chief Engineer Martin and the trustees of the bridge have visited these roads and have become convinced of the practicability of handling the bridge trains by electric power. To enable the trustees and the engineer to judge of the advantages which electric motive power might offer over the steam power hitherto employed for switching service, bids were called for for the proposed electrical equipment. Consideration was only given, however, to two propositions, that of the General Electric Co., which had already fully developed apparatus applicable to heavy electrical traction work, and which equipped the three roads above mentioned, and that of the Westinghouse Co. It is stated that the latter concern declined, but the former responded offering to fully equip one car for experimental demonstration of the problem.

If the general plan adopted at first proves economical as well as satisfactory, a certain number of cars will be equipped with four motors, one on each axle. These cars are to be known as motor cars and each will remain with its own train at all times, switching it from the incoming to the outgoing tracks and pulling or pushing it over the tilting sheaves when the grips will take up the cable and the motors cease work. Should the grips slip while the train is mounting the grade, which is 3.78, the motors can come again into requisition and assist the trains over the summit. Moreover, during the early morning hours when traffic has become light and the cable is no longer running the trains can be operated entirely by motor cars, as they now are by locomotives. The eventual outcome will probably be the exclusive operation of the Bridge Railroad by these motor cars. Meanwhile they will switch the trains, and as each train is equipped with its own switching power, the motor car, all the interference which the steam locomotives have hitherto placed in the way of the incoming and outgoing trains will be done away with and the complexity of the switching be greatly reduced. At present, the time consumed in switching a train is 20 seconds and in that time a vast number



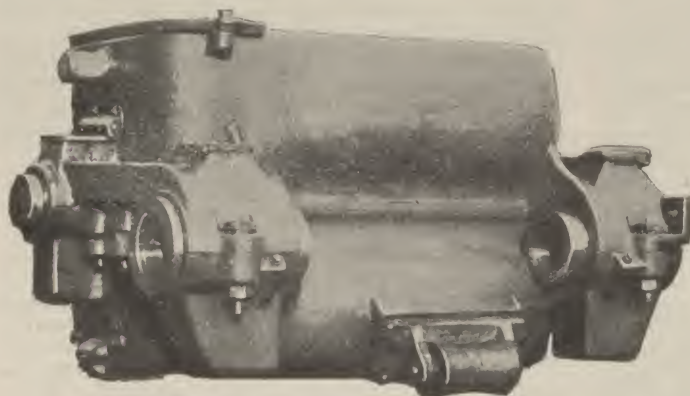
BROOKLYN BRIDGE MOTOR CAR SHOWING TRACKS.

of people gather on the platforms. With the new motor and the new principle of operation it is expected that passengers will at all times have cars waiting for them. Besides the gain in time in the switching process all the inconveniences of the locomotives—the noise, smoke, steam and gases will be eliminated and this in itself will be no small gain.

Car No. 76, one of the regular passenger cars of the Brooklyn Bridge has been selected to receive the first electrical equipment. All the apparatus, with the exception of the controlling handles and circuit breakers will be placed out of sight beneath the floor

will exert a horizontal effort of 1,200 lbs., when mounted on a 33-inch wheel. Four of these motors are employed, one to each axle or two to each truck. They are completely encased and are water and dust tight. The armatures are of the well known iron-clad type, the windings being sunk into slots in the armature core. The Eickemeyer winding is used on the armature. By this method the crossing of two wires of large difference of potential is avoided.

The insulation is substantial and each segment of the commutator is of hard drawn copper. The armature is mounted on a sleeve keyed to the shaft,



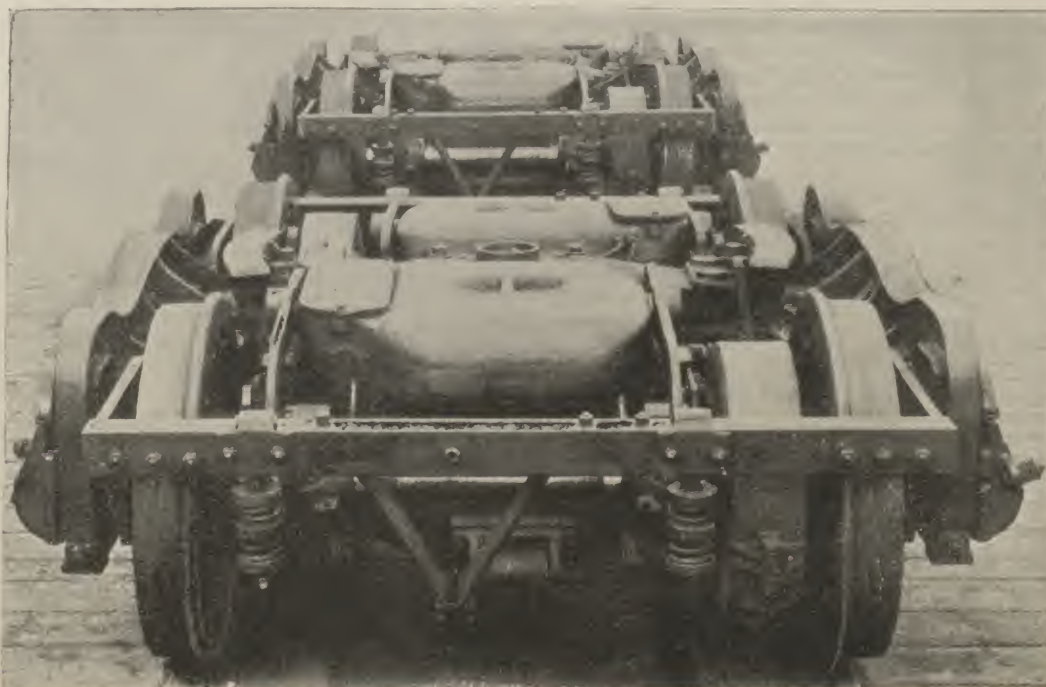
BROOKLYN BRIDGE MOTOR.

of the car. The ordinary light Pullman trucks on which it has hitherto run and the cable grip mechanism have been removed. Heavier trucks were necessary to carry the motors. These were supplied by the McGuire Co. of Chicago and combine the best features of the passenger and locomotive truck. These are illustrated elsewhere in this issue in connection with the electrical equipment of the Lake Street Elevated of Chicago. The general character of the motor equipment is similar to that in use on the Metropolitan Elevated and Nantasket Beach roads above mentioned. The motors are known as the G. E. 1200 from the fact that under normal conditions which



BROOKLYN BRIDGE TROLLEY CONNECTION.

which may be withdrawn without interfering with the armature structure. The field frame is of cast steel. The ratio of reduction between the armature shaft pinion and the wheel gear is 3.5 to 1. Each motor weighs about 3,000 lbs. With this equipment and the regular train a speed of about 15 miles an hour may be obtained. Each motor is suspended on the truck from two trunnions in the upper field set in two bars, the outer ends of the bar resting on elliptical springs. At the base of each motor, facing the ends of the car, is a small roller which depresses the cable and allows it to pass the motors without injury, while a long iron bar runs beneath the truck and de-



BROOKLYN BRIDGE MOTOR TRUCKS SHOWING MOTORS AND ATTACHMENTS.

presses the tilting sheaves, preventing them from striking the motors.

The operation of the motors is controlled by series parallel controllers of the L 4 type, which have given such general satisfaction on the Chicago roads. The indicating dial of the controller is placed at the top of the platform rail and is lettered "series", "multiple" and "off", showing exactly the position of the controller itself. The reversing handle is a jointed handle, which can be placed on or taken off the reversing switch spindle only when the controller handle points to the "off" position, showing that there is no current in the motors at that moment. The controller itself has no effect until the long arm of this jointed handle is dropped into the "forward" or "reversing" notches in the reversing handle plate. There are two controllers, each operated from its own platform, and either controller will operate the four motors or any two of them, as may be desired. The resistances as well as the magnetic cutouts are also placed beneath the car floor. Beneath each hood of the car is an automatic circuit breaker, placed within easy reach of the motorman. The operation of this device is instantaneous and is an effectual safeguard against any accident to the motor. These circuit breakers take the place of the main circuit hood switches, but are wired in multiple with each other instead of in series. To guard against any possibility of one being closed while the motorman is at the other end of the car and desiring to open his main circuit, only one handle is provided. The handle cannot be taken off without opening the circuit breaker, and when removed the circuit is locked open. As the motorman must take the controller and circuit breaker handles with him when changing ends, all danger of complication is avoided.

The car is equipped with 12 electric heaters, manufactured by the Consolidated Car Heating Co., of Albany, N. Y. This system of heating has been extensively adopted on the surface cars in the city of Brooklyn and the consequent abolition of the objectionable stove has caused a general feeling of relief. The heaters consist of a slab of porcelain in front of which is a cylinder of porcelain wound with galvanized iron wire. These heaters have a maximum capacity of 40 sq. ft. radiating surface at 400 deg. Fahr. Five different temperatures to suit the weather can be obtained by means of a controlling switch.

The collector which will take the current from the overhead wire is a diamond shaped frame of metal set longitudinally upon the roof of the car and carrying at right angles a bar in the center of which is a roller. The arms are wide enough to preclude any possibility of missing contact. The diamond frame is depressable and expansible on the principle of the pantograph, allowing a play up and down to conform to the varying heights of the overhead wire. With this collector the trouble of reversing is entirely done away with. The power to run the car will be taken from the overhead wire already in position supplying current to the electric lights in the cars. The extra current, however, will be supplied from the Fulton street-feeder of the Kent avenue station of the Brooklyn City Railway, the return wire being connected to the rails of the surface road.

AIR BRAKES ON METROPOLITAN ELEVATED OF CHICAGO.

The air compressors used upon the Metropolitan West Side Elevated Railroad of Chicago for obtaining the power for the air brakes are driven by enclosed motors furnished by the Storey Motor & Tool Co., Philadelphia, which are run at a speed of 650 revolutions per minute by a current of 450 volts. They develop $3\frac{1}{2}$ horse power and occupy a space 15 x 30 in. and weigh 400 lbs. each. The motors are connected directly to the air compressors the construction of which are shown by the accompanying illustration. The compressors were furnished by the New York Air Brake Co., from whom the following description of the system and the claims made therefor has been received. Comments upon the different systems used in elevated railway service will be found in the editorial columns of this issue.

As the trains have to be started and stopped every two or three minutes, it is essential in order to reach any average speed that may properly be termed "rapid transit" that they should be able to obtain the maximum speed quickly and to maintain that

speed as long as possible. The problem of stopping quickly at a definite point without any shock or jar is quite different from merely being able to make an abrupt stop to avoid an accident. Passengers might be willing to be slid off the seats once in a lifetime if such a stop prevented a worse smash up by collision, but as a regular thing they prefer to quietly

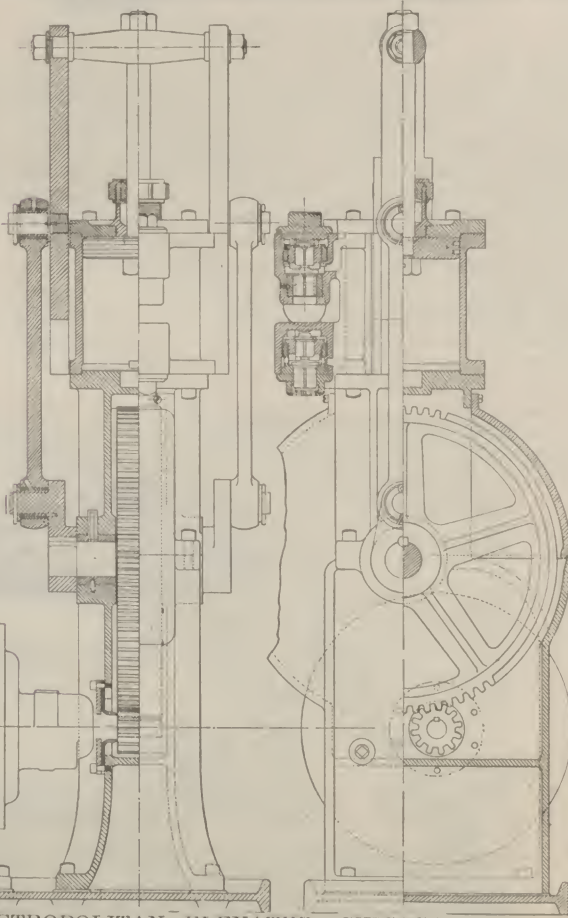
read their paper and not realize that the train has been stopped at all. To make quick smooth stops it is necessary that the brakes should be applied with the maximum force while the train is running at full speed, and that this force should be reduced gradually as the speed slackens so that the brakes are nearly released when the stop occurs. In order to stop at definite points it is also necessary that the engineer may increase or decrease the brake pressure at will while the brakes are on. These qualifications are not found in the quick action automatic brake system. If the quick action feature is brought into service, the brake pressure cannot be varied at the will of the engineer; nor can he increase or decrease the brake pressure at will while the brakes are on. If only the service action is used valuable time is lost for the brakes are applied several hundred feet before reaching a station, and if applied too hard must be released and reapplied when the train is running slow, with a result that is anything but agreeable to the passengers. The automatic system is not sufficiently under the control of the engineer to permit of the variation that is essential for quick smooth stops at definite points. Its control is like an arrow from a bow. It can be started with great force, but cannot be modified or controlled. The brake system used to this road was designed especially to fulfil the following conditions:

1. The power can be quickly applied to maximum force.
2. The brake pressure can be diminished or increased at will while the brakes are on.
3. The full release is obtained very promptly.
4. The consumption of compressed air is very small.

It consists of usual foundation brake rigging, operated by a brake cylinder of the ordinary construction, and a reinforce cylinder, which comes into action after the ordinary cylinder has taken up the slack and brought a moderate pressure upon the brake shoes. By this means a short stroke of the reinforce piston is enabled to increase the brake pressure three-fold with a very small volume of compressed air. The main brake cylinder is always open to the train pipe and the reinforce cylinder is controlled automatically by the pressure in the main cylinder. Therefore, the engineer, by varying the pressure in the train pipe can vary the pressure in the brake cylinder at will. This enables him to control the brake power with the same facility that he can control the motive power. This brake system was first used on the intramural railway at the world's fair, and its success there led to its adoption for this rapid transit service.

Engineers' Club of St. Louis.

The January meeting of the Engineers' Club of St. Louis was called to order by President Ockerson on the 22nd of that month. Applications for membership were announced from W. G. Comber, U. S. assistant engineer; Horace Dunaway, surveyor with Mississippi river com-



AIR COMPRESSOR METROPOLITAN ELEVATED, CHICAGO.

mission; and J. L. Van Ornum, instructor civil engineering, Washington University.

Mr. E. J. Spencer then addressed the club on "Underground Electrical Service," giving the results of the wide study and varied experience which the speaker had had in work of this character, in different parts of the country. He reviewed the historical features of the subject, explaining the work done both at home and abroad, the diffi-

culties which had been met with and how they had been overcome.

It was not generally known that the first experiments with the Morse telegraph were made with underground circuits; these gave so much trouble that the entire matter was on the point of being dropped, when an assistant suggested trying overhead wires. This being done, the experiment was immediately successful. The speaker explained the work which had been done in New York, Philadelphia, Boston, Chicago and elsewhere, and regretted the fact that St. Louis was moving so slowly. He stated that there was no city east of St. Louis of 150,000 inhabitants or more which did not have its wires underground in the business districts. He showed a number of samples of cables of different types and for a wide variety of purposes.

Messrs. Moore, Bryan and Flad participated in the discussion.

A RAILWAY BRIDGE AND BUILDING DEPARTMENT.

ONWARD BATES, M. AM. SOC. C. E., M. INST. C. E.

A good way to commence in the bridge and building department is as assistant engineer on a railway which has enough work to justify the employment of such assistants. Any young man is fortunate who can, at the beginning of his career, obtain employment in his chosen occupation, with a living salary, and with such a start, his future should depend principally upon his own exertions. At the same time it is to the company's interest that each employe shall have the largest possible opportunity for self-improvement, because the service is benefitted by the improvement of the individuals engaged in it. Therefore, the head of the bridge and building department should for the sake of the service, as well as for his personal obligation to one whose fate is more or less in his charge, push forward the education of the assistant, teaching him by instruction and by varying the nature of his employment, to acquire an all around efficiency in the work of the department. The assistant should bear in mind that the highest positions in the line of his employment are to be secured by those who earn them, and he should set his mark at nothing less than the highest. With self-improvement he will obtain advancement, either in the service in which he has been educated or in a similar service on other railways. It is the custom in the railway service generally to buy and sell employment and "value received" measures the relationship between the company and its employes. While favoritism may sometimes affect the service, it is something which is condemned by right minded men; and as for other sentimental considerations such as long and faithful service, and reserve ability which may only be called into service in certain emergencies, my observation does not lead me to believe that it is safe for a beginner to build upon them. I question if this condition of paying the present value for service performed, and measuring the relationship between the company and the employes on a purely business basis is not really the best for all concerned. When there are no contingent rewards to be considered, each party to the contract for service is held to the performance of present duty, and the highest theory of life is to do what is right now, making of course, reasonable plans for the future, without neglecting present opportunities. You should therefore fulfill every present duty, gathering in the process, that self-improvement which is your capital stock, and the satisfaction which accompanies the performance of duty.

The duty of self advancement is never antagonistic to loyalty to the company, nor to proper respect for your associates in its service, including your inferiors as well as your superiors in rank. Discipline is almost a first consideration in the bridge and building department which has to meet questions of safety to individuals and to the public, as well as those which concern the welfare of the company. Discipline requires, primarily, obedience to orders and respect for authority. It requires that you must respect "position" aside from the estimation in which you hold the individual who occupies the position. It requires that you shall be fair and just to all of your associates of every rank. It is implied in your contract for service, though it may be only a simple engagement without any expressed specifications, that you are to serve the company to the best of your ability, and that it has a first lien on all of your business and professional attainments. The strictest regard for obligations and for discipline are entirely consistent with the moral relations which should be maintained with your associates, and with the tie of common interest your intercourse with them should be harmonious.

It is essential for proper management of work to have a complete and thorough knowledge not only of your own duties and responsibilities, but of those belonging to all with whom you do business. You should know the working organization of your company, all of its departments, the class of work or business belonging to each department, and the relative rank of departments and individuals in the service.

The bridge and building department has to do business in one way or another, with the track, the rolling stock and machinery, the transportation, the store, the purchasing, the legal, the pay, the traffic, and the claim departments. It is necessary to have

a knowledge of the working methods of each of these in order to work under or with them as the case demands, and efficient co-operation will be greatly benefitted by personal acquaintance with the officials in each department.

All established forms for reports, requisitions, etc., should be strictly adhered to in conducting business, and when there is a method established for any business, it should be followed or the method changed. The greatest disorganizers are those who assume to live and act regardless of rules and customs, because forsooth, they are not what they should be. Of all occupations the operation and maintenance of a railway should be the most methodical, and yet the greatest enemies to method are sometimes those men of strong character, who by the force of personal ability have risen to places of importance. These men who rely solely on their own knowledge and experience have their limitations, and the business in their charge is liable to grow until it outgrows the one man power, and they find themselves "back numbers", because they have not created the machinery of organization which would enable them to control it. It seems as if engineers as a class do not realize that, with the exception of the genius for invention, there is nothing which will contribute so greatly to success as management. Just as the blacksmith manages the iron, and brings the pieces of metal together at a welding heat and then applies the mechanical process which makes a good job of the weld, so should the engineer bring his material and appliances and men into the right conjunction for accomplishing his ends. In the bridge and building department he will require the assistance which can be furnished by other departments of the company's service, and this can best be obtained by application through the appointed channels. The bridge and building department is an internal member of the railway organization. Its office is mechanical, and it has no business with the public except such as is specially delegated to it. Thus it is sometimes included among the duties of the head of the department to procure the stone, the iron bridges and turntables, and the special machinery which require technical inspection and supervision, and the dealing with employees of other railways in cases of joint ownership of structures.

The success of this department is measured in dollars and cents, and that is the best management which is the most economical. This does not mean that its product shall be cheap, but that the best returns shall be received for the expenditures. There are many things to determine the class of work and the materials to be used in construction, and frequently the controlling element in deciding any case is one of which only the general officers of the railway are informed, and the employees of the department have not the knowledge which makes them competent to criticize. In such an instance discipline requires obedience to instructions, and criticism by subordinates is either thoughtless or disloyal, and should be discouraged in one case and condemned in the other. While the policy governing construction and maintenance may be decided for you and without your advice, you should be prepared to advise on proper occasions, and to meet the responsibility of decision in the work which is left to your discretion. This will require you to study all of the conditions affecting your work, and calls for extended experience and sound judgment. Experience results from practice; that is, from intelligent and observing practice. Both good and bad results in individual cases should be stored in your mind that one class may be repeated and the other avoided. You are fortunate in the amount of recorded experience of others which is at your command in our technical journals and society transactions. This book and newspaper knowledge is most valuable when combined with your own practical experience, or with your actual observation of the work of others. In this connection I wish to impress upon you the benefit of object lessons, and to emphasize it will give you a leaf from my own experience.

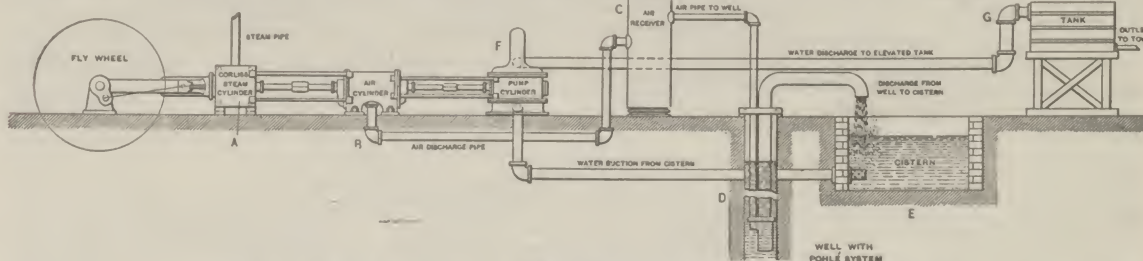
For many years I was employed on bridge construction and other special work where the job in hand occupied my attention, and while I was acquiring valuable experience it was in the nature of doing and judging good work, and my sphere of observation was limited to the case in hand. I then found myself at the head of a bridge and building department extending over 6,000 miles of railway, with more than a thousand stations, eight times as many bridges, and other structures in proportion. It was incumbent on me to have such personal knowledge of these structures as was obtainable, and I found an object lesson that I was poorly prepared to learn. Day after day using all the daylight available, I have been seated in the observation end of a business car making inspection trips with some of the higher officers of the railway, trying to familiarize myself with the appearance and condition of the structures, getting glimpses of bridges and other structures as we passed them, and making hasty examination of station buildings when we stopped. The result was confusing and first impressions were jumbled together in my mind. After many such trips the individual structures began to stand out distinctly in my mind, and now after eight years of such experience I find that I am much assisted in ordering the work of repairs by my personal knowledge of the structures;

and that my powers and habit of observation are greatly increased. I am beginning to see what my eyes look at, and to store in my memory those facts which I have need of, and when I reflect upon the value which an earlier education of this kind would have been to me I feel that I ought to impress upon you as strongly as I can the desirability of cultivating the habit of observation.

The bridge and building department should have in charge the design, construction and maintenance, of all structures on the railway, with the exception of track, and of rolling stock and machinery. These structures include bridges, culverts, turntables, buildings of every class, track and stock scales, clinker and cinder pits, stock yards, wells and other sources of water supply, windmills and pumps of all kinds, tanks and standpipes, appliances for storing coal and sand and delivering same to locomotives, and miscellaneous structures of every description.

While it is the province of the bridge and building department to perform the work indicated above, it should not be permitted to decide upon the amount and character of the work in each case, except in conformity with the instructions which shall from time to time be issued for its guidance. The sources of authority for expenditures in the department vary on different railways, and as I must assume a type for the purpose of this paper, I will try to explain how the work may be properly authorized on a typical railway.

The care of bridges and culverts is the first duty of the bridge and building department. It is responsible for their being kept in safe condition for passage of trains. The authority to make all ordinary repairs should be vested in the head of the department as the employee who is responsible to the company for the safety of its structures. He should also be the one to decide what shall be done in cases of wreck or other emergencies, and when circumstances do not permit of reference of such cases to him for decision, his assistant next in authority, who is at the scene of action, should represent him in making emergency repairs. In this connection it must always be remembered that the department is only one branch of the maintenance department, and should work in harmony with all employees of the company with whom it comes in contact. Cases of emergency will sometimes try the loyalty and discipline of the employees, and they must be prepared to put off all differences and disputes until the emergency no longer exists. There are always general rules which take precedence of department rules, and in formulating the latter, care should be taken that they do not conflict with the former. "Timetable rules" take first rank because their first consideration is safety of passengers and employees in charge of the movement of trains have under these rules the right in cases of emergency to command the services of any available employee of the company and, for the time at least, to decide what is a case of emergency. The head of the department should re-



THE POHLE AIR LIFT PUMP APPLIED TO WATER WORKS.

ceive the approval of the officer to whom he reports, before undertaking any extraordinary repairs or renewals, or changes in the class of bridges or culverts which are to be renewed. Bridges and culverts cannot be dispensed with as long as trains go over them, and the only questions which should require approval outside of the department are those which involve changes from wood to iron, stone or earthwork, or changes resulting from the conditions attending any particular structure.

While safety is the first consideration in the maintenance of bridges and culverts that are tested with every train, there are other considerations which will control the kind and extent of work in the maintenance of structures other than bridges and culverts. The necessity for the maintenance of these other structures is not a fixed quantity as with the bridges and culverts, and the uses to which they are to be applied are to be considered in maintaining them. As parts of the machine they contribute to the convenience and economy of its operation, in varying degrees, and it is always in order to consider what returns will be made on the amount invested in their maintenance. With regard to safety, the use of turntable, scales, clinker pits, cinder pits (except in main track), stock yards, coal houses, etc., may be dispensed with; and expenditures should not be made on them unless warranted by the demand for them. In some cases, while it is convenient to use an existing turntable or other structure, some other turntable or structure may be nearly as convenient, and if the one gives out, it may be good policy to abandon it and use the other. In other cases an existing structure may be located in an undesirable position, and before renewal or extensive repairs are begun, the question of a new location

should be considered. The maintenance of depot buildings and similar structures will always depend upon the purpose which they serve. The water and coal supply should be renewed in conformity with the demands of the transportation department for water and coal.

From all of which it will be seen that the officer controlling the operation of the machine have as much and perhaps more to say about the maintenance of these structures than the one who has charge of such work as is concluded to be necessary. The officer referred to is the division superintendent who operates the machine and controls the business of transportation, as well as all the public business of the company on his division. It is unnecessary for us to consider at this point whether the decisions of the division superintendent are final, or require confirmation by his superior officer. He is the one who knows whether a turntable or a track scale may be abandoned, or if there is a more convenient location for it; he knows whether the stock business at any station requires that the stock yards shall be kept in condition to be used; it is for him to say what repairs are needed to station buildings, etc.; he is the custodian of the company's property on his division, and the proper officer to decide upon the different items of this secondary class of structures. He makes the working timetables, controlling the operation of trains, and knows at what points water and coal are required for locomotives, and in what quantities. Therefore the authority for all the work of the second class (it being understood that the first class refers only to bridges and culverts) should originate with the division superintendent. The specifications for this work and the execution of it belong to the bridge and building department.

ERHARDT PROCESS IN METAL WORKING.

Among the most important of recent German inventions in the field of mechanics is unquestionably the Erhardt process and apparatus for manufacturing tubular bodies, which has been patented in Europe and America, and has been during the past two years in highly successful operation at the works of the Rhenisch Metal Ware & Machine Company at Düsseldorf.

The principle underlying this process appears not to be entirely new, a somewhat analogous method having been already employed on a limited scale in England, but the machinery and working methods devised by the German inventor are so far in advance of all precedents that his patents, even in the United States, are claimed to be fundamental and comprehensive.

The process in question is for making tubes of all kinds, gun barrels, hollow projectiles, acid flasks, parts of machinery which combine the utmost degree of lightness with adequate strength—in fact, an indefinite variety of hollow metallic articles by thrust-

ing a steel core or mandrel through a billet of hot steel, wrought iron or other metal, which is held firmly in a matrix of such shape and caliber as to give the required outward form to the completed object.

In the works at Düsseldorf the mandrels are operated by hydraulic pressure, and are usually set in a horizontal position, though this is immaterial, the matrices being held in position in massive iron bed frames and carefully adjusted so that the mandrel, being steadied at the point of impact by firmly fixed guides, shall pierce the exact center of the billet, and by compressing the yielding metal outwardly into the space between the mandrel and the matrix produce a hollow body, the shell of which is everywhere of exact and uniform thickness. Both mandrel and matrix, or either of them, may be round, square, hexagonal, or of any other desired sectional shape, so that round, square, or otherwise formed tubes may be made with equal facility. Not only wrought iron and steel, but copper and other malleable metals are worked with entire success by this process, the only requirement being that the blank billet, in case of each different metal, shall be worked at such temperature as to secure its highest degree of malleability and ductility.

When a gun is made by the old method of forging a solid blank, which is then hollowed out by boring, it may often happen that the firmest and most homogeneous part of the steel at the core of the billet is cut away by the drill, which reveals nothing of the flaws and imperfections that may exist in the interior surface of the barrel. Similar defects may occur in boiler or in other tubes may be welded or by other processes ordinarily employed; but by the Erhardt process, the solid cube of metal is pierced, forced

through the matrix, elongated or driven by lateral displacement into its new form by its steady, resistless power, which compresses the metal to a high degree, welds and obliterates every flaw or seam, and leaves, as the hardest, densest portion of the tube or barrel the interior surface of its bore. This pressure is so great that when the mandrel is withdrawn the surface which it leaves has a glistening appearance, as though polished by friction or hammering.

Among the varied purposes to which the process has been applied at Dusseldorf, the two simplest and most susceptible of ready description are the manufacture of shrapnel shells for the German field artillery and steel flasks for containing liquid carbonic and other acids. The problem, in the first instance, is to make by the best and cheapest method a hollow, pointed steel projectile, about 3 in. in diameter by 12 in. in length, the shell of which is about one-fourth of an inch in thickness and of exactly uniform weight on all sides, so as to secure to the projectile a perfect axial rotation when in flight. For this purpose a 3 in. cube of mild steel, heated to cherry red, is dropped into a slot at the opening of the matrix. A touch upon the lever controlling the hydraulic press starts the mandrel, which, with one noiseless thrust, pierces the billet, drives it through the matrix, draws it out like wax, spreading the pliant metal over the end of the mandrel like the finger of a glove, shoves the end of it into a die which tapers it to a point, and, within two seconds of time, the process is complete.

Similarly, from larger steel billets, acid flasks 4 or 5 ft. long by 8 in. in caliber are made and shaped by a single movement of the press, without a seam or flaw, and of such quality that its thin shell sustains an expansive pressure of 250 atmospheres. So superior, indeed, is the work turned out by this method, that the German government has required the principal maker of guns and projectiles in this country to adopt the Erhardt process for the manufacture of such war material as is delivered for the use of its army and navy. The same system works equally well in the manufacture of hollow projectiles of all larger sizes and in making steel cannon tubes of 3 in., 6 in., and greater calibers. In all these specialties, the quality of the product is pronounced by ordnance officers not only superior to that of shells and guns made by other methods, but the economy in cost is said to be fully 50 per cent. Copper tubes of all ordinary sizes and of any length up to 20 ft. are likewise made by the Erhardt process, the limitations of which, in respect to diameter, length and shell thickness of the hollow body produced, are fixed only by the size of the machinery and the degree of dynamic force employed.

But the ultimate value of the invention will be measured by its application to mechanical construction in substituting hollow, and, therefore, lighter parts of machinery and structural forms for those which are now made of solid metal. The progress of modern mechanics is toward the utmost economy of power through the saving of friction, directness, and simplicity of coupling, and lightness of construction in all working parts. In all this wide and important field of improvement, the process herein described seems likely to play so important a part that its successful introduction, already an accomplished fact, is believed by competent engineers to mark an epoch in the progress of metal working. —[Frank H. Mason in Consular Reports.]

A BUILT-UP PRESSED STEEL TRUCK FRAME.

A new form of pressed steel truck frame has just been patented by Mr. Charles P. Schoen of Philadelphia, which is shown in detail in the accompanying illustrations. Fig. 1 shows a half plan view, Fig. 2 an end elevation and Fig. 3 a side elevation of the truck. The side frames are composed of a compression member of pressed steel in the form of a channel having its flanges projecting outwardly. This member is bent downward at the ends, forming the outside pedestal, which is projected some distance below the level of the tension member. The lower, or tension member, is turned up to meet the upper

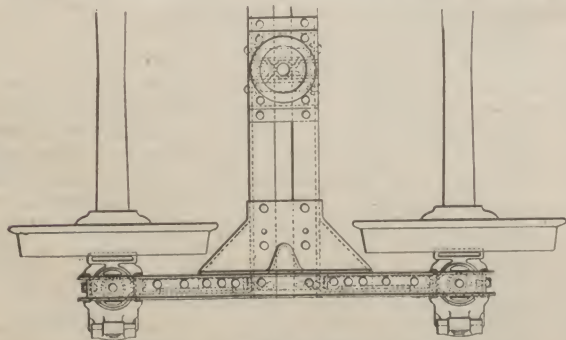


FIG. 1.—HALF PLAN VIEW.

chord, and is extended horizontally across the spring seat and down a sufficient distance along the outer jaw to admit of its being riveted thereto, as shown. By this means the corner turned by the upper chord is reinforced and stiffened. The space between the chords is occupied by struts pressed into channel form and cut away at the center for lightness. The pedestals are provided with flanged steel chafing

plates, one form of which, not shown in the illustrations, is so arranged as to cause them to spring inwardly toward the center of the axle to take up lost motion and center the box. The method of securing the pedestals at the bottom is by means of an angle piece on the inner side of the inner pedestal jaw, which is connected to the outer jaw by means of a U-shaped plate.

In place of a bolster a rigid transom is used, which consists of two pressed steel channel beams, the flanges of which face each other. They are riveted

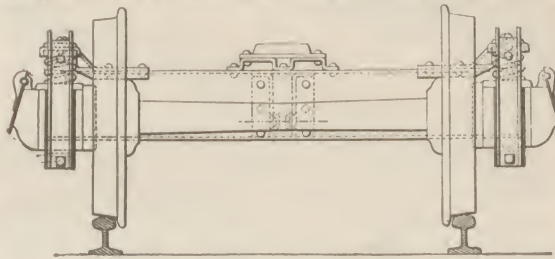


FIG. 2.—END ELEVATION.

to the lower chords and to the flanges of the struts. They are also connected to the upper chord by connecting plates of pressed steel. These plates are provided with flanges which embrace the sides of the transom, and from their connection with the transom they extend outwardly with the outline similar to the letter Y, after which the plate has a right angle rise surmounted by a horizontal flange. The rise is reinforced by a swell bracket at the center. The body portions of the connections are riveted to the transoms, the horizontal flanges are riveted to the upper chords, and the rises abut against the sides, thus forming a very rigid and secure union between the transom and the sides. The transom is braced at the center pin by flanged tie plates riveted to the webs of the transom channels and having em-

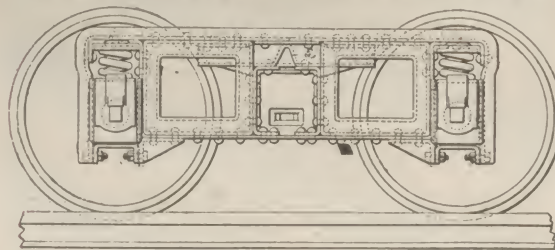


FIG. 3.—SIDE ELEVATION.

bossed portions, which serve as a pocket for the center pin. The connection pieces and tie-plates are also of pressed steel. The center bearing plate is mounted upon the spacing plate, which is riveted to the top flanges of the channels.

The claims made for this construction are that it is possible to put together in this way a perfectly strong and durable side frame of the composite form in which the thickness of the different members may be arranged to suit the work, which has to be performed by them; for instance, the bottom chord may be made of $\frac{1}{2}$ in. material, the connecting struts may be $\frac{3}{8}$ in. thick, and the top chord one of $\frac{1}{2}$ in. material, which it is claimed will materially reduce the cost of construction over those forms which employ solid metal of uniform thickness throughout. Attention is called to the utilization of the tie plates to form a pocket for the king-bolt, whereby the use of a cast tie plate below the transom is avoided. It must not in any sense be considered that these illustrations are working drawings; they merely indicate the principles involved.

A landslide near Georgetown, Pa., occurred Dec. 31, on the line of the Pennsylvania Railroad, just as a freight train was passing. The engine and five cars were carried into the river, and six other cars were buried in the slide, which was about 300 feet long and 25 feet deep. Five men were injured.

TRUCKS FOR LAKE STREET ELEVATED ELECTRIC MOTOR CARS.

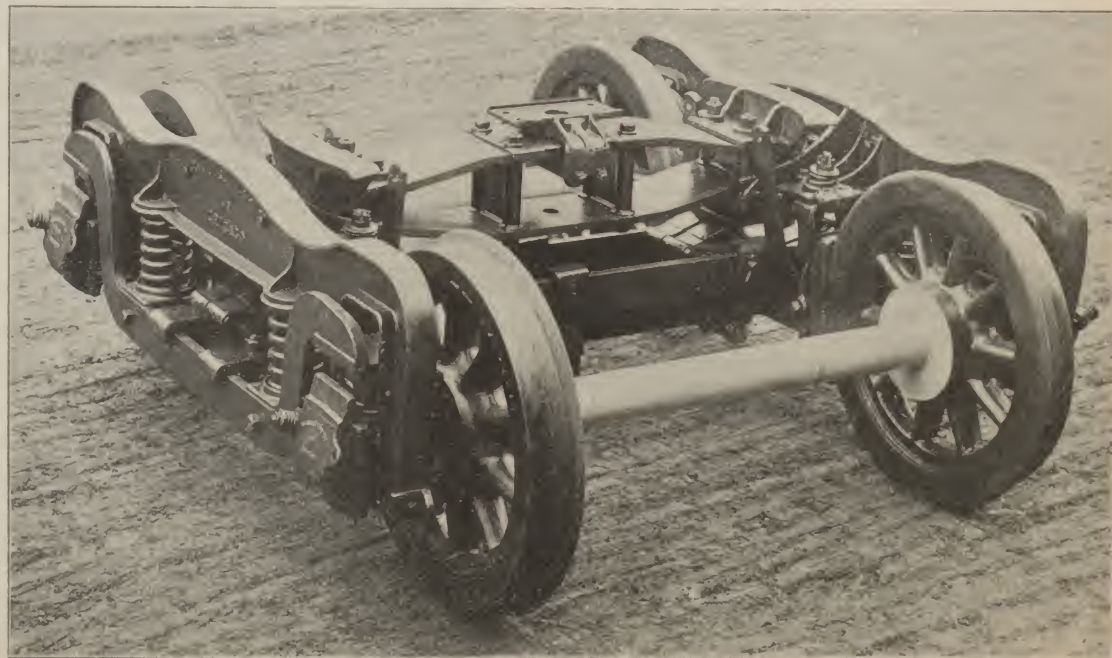
The fact has been mentioned in these columns that the Lake Street Elevated Railroad is engaged upon a change from steam to electric traction, and there are several novel features which are being introduced in this work, the most interesting of which is the design of the motor trucks. Mr. Chas. V. Weston, chief engineer of the road prepared general specifications of the requirements from which the following notes are taken.

The cars under which these trucks will be operated are 46 ft. long overall, and the weight of a car and its load exclusive of trucks will be 38,000 lbs. The motors are to be of a type known as "G. E. 2000."

These motors are 33 in. high, 53 in. wide, and the distance from the truck axle to the center of the motor is about 25 in. They weigh 4,200 lbs. each. It is expected that trains will develop speeds as high as 40 miles per hour on straight lines, and the cars will be operated around curves of 90 ft. radius at speeds of 10 miles per hour. The trucks are required to have lateral and vertical motion, and the wheel base is not to exceed 6 ft. The distance between truck centers is 32 ft. The springs are required to be of the manufacture of the A. French Spring Co. All parts of the truck are required to be built to templates so as to be interchangeable. The axles are to be of the best hammered steel with $\frac{5}{8}$ in. wheel fits, and with $4\frac{1}{2}$ x 8 in. journals, without collars. The braking apparatus is required to be so placed as to clear all parts of the motors, and so arranged that it can be operated by air, or by hand as usual. The brake shoes are to be of the Lappin flanged type. The bolts used for the construction are required to be driving fits in the holes which are to be reamed and all bolts are to be secured by nut locks. Three builders are now engaged in the construction of trucks. The McGuire Mfg. Co., of Chicago, are building fifty, the Baldwin Locomotive Works are building eight, and the J. G. Brill Co. of Philadelphia are building two. Through the courtesy of Mr. Weston and the manufacturers we are enabled to illustrate the construction and the designs submitted by the McGuire and the Brill people. The Baldwin design is similar to the one illustrated in the RAILWAY REVIEW of May 11, 1895, page 259, which is used upon the Metropolitan West Side Elevated of Chicago, except that it has a swinging bolster and some other modifications which constitute improvements over the earlier design.

The wheels for the trucks are required to be made according to the drawings furnished by the chief engineer of the road, who designed a wheel for the special conditions, and which strongly resembles a locomotive truck wheel. The centers are of cast iron with solid spokes and rims, the construction being very solid and heavy. The wheels are 33 in. in diameter over the tires, and the centers are turned to a diameter of 28 in. The Gibson retaining rings are used, and the tires are of Krupp manufacture. The large ends of the spokes are elliptical $3\frac{1}{2}$ x $2\frac{1}{2}$ in., while at the small end they are $3\frac{1}{2}$ x $2\frac{1}{2}$ in. They are nearly the same pattern as that known as No. 1 of the National Wheel Co. The wheels are required to weigh a least 700 lbs., and actually weigh about 800 lbs.

The design from which the McGuire Manufacturing Co. is working is illustrated in Figs. 1, 2, 3 and 4. This truck is also being used upon the Brooklyn bridge, as noted elsewhere in this issue. It is arranged for special use upon elevated and high speed surface roads, and to give the same easy motion found in modern passenger cars. Reference to the drawings will show the employment of the form of equalizing bars used on passenger trucks, which are mounted upon the journal boxes in the usual manner, except that cushioned springs are interposed be-



LAKE STREET "L" ELECTRIC MOTOR TRUCK—FIG. 1—DESIGN OF MCGUIRE MFG. CO.

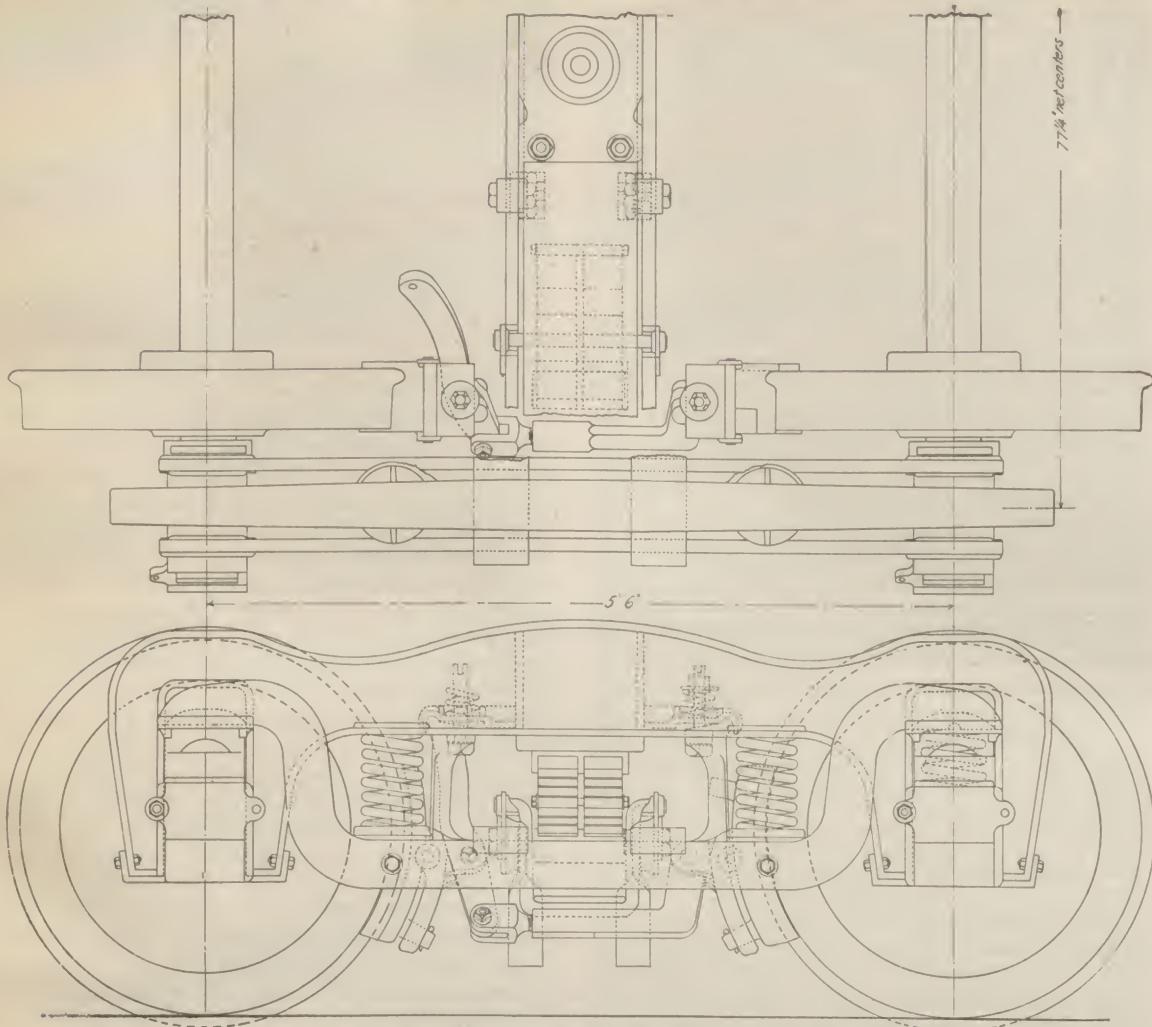


FIG. 2.—SIDE ELEVATION AND HALF PLAN SHOWING BRAKE ATTACHMENT.

tween their ends and the tops of the journal boxes. The equalizers are double, two to each side of the truck, and they are made of $1\frac{1}{2} \times 4\frac{1}{2}$ in. wrought iron. Upon these equalizers are mounted two suspension bars, or cross sills, with the same cross section as the equalizers, and from these the electric motors are suspended so that the wheels, axles, equalizers and motors all move together and are entirely independent of the truck frame and car body. This much of the truck frame and car body. This much of the truck constitutes what might be termed the locomotive, which it will be noticed is cushioned upon the journal boxes, and upon this locomotive frame, what might be termed the passenger truck is mounted. Two equalizer springs are mounted upon each pair of equalizers, and from the 2 suspension bars are hung a spring plank on inclined swing links. This spring plank carries two elliptic springs on each end, or four per truck, as shown in Fig. 1, and the truck frame is mounted upon the 4 spiral equalizer springs, and the four elliptic springs in such a manner as to distribute the weight equally upon the springs. The truck frame consists of 2 side pieces of malleable iron furnished by the National Malleable Castings Co., having pedestal jaws cast therein, for receiving the journal boxes. The frames are arranged for a lateral motion of $1\frac{1}{2}$ in. of the wheels in either direction independently of the truck frame.

These side pieces are fastened together very rigidly by a truck bolster 10 in. deep made of two 1×10 in. wrought iron plates. The bottom plate is turned over itself at the end forming a seat against which the upper plate abuts and these joints are made perfect by milling the ends of the lower plates and planing those of the upper ones. There are four sets of pillar castings through which bolts pass to secure the plates of the bolster together. This member is fitted at its ends into strongly webbed pockets formed on the inside faces of the side pieces. And this constitutes a seat for the end of the bolster 16 in. long at each end to which the bolster is securely bolted. This construction of the truck frame holds the truck rigidly in square, and connects the journal boxes of the driving wheels directly with their load. All the pulling is done by the journal boxes against the pedestal

jaws, which are directly and rigidly connected with the load without the intervention of a swinging vertically vibrating bolster.

Another interesting feature is the attachment of the brakes which are located inside of the wheels and are supported by brackets from the side frames, as shown in Figs. 1 and 4. This avoids the necessity of extending the truck frame beyond the wheels and admits of making a short compact truck. The brakes are equalized and do not interfere in any way with the motors. The brakes are suspended from the brackets by patented brake hangers which form shoe backs, brake hangers, equalizing levers, and adjustable release springs, all in one, and at the same time take up the lost motion preventing chattering of the brakes

impression of strength and durability. They weigh 8,000 lbs. apiece, whereas, those for the Brooklyn bridge on account of added parts for the support of the motors weigh 8,700 lbs. each. Attention is called to the construction of the malleable iron center plates which are clearly shown in the illustrations. These are so designed as to hold the truck in place in case the center pin breaks, and to also hold the truck from falling in case the car should be pushed over the end of the structure.

The truck designed by the J. G. Brill Company differs in many respects from the one just mentioned. This construction is shown in Fig. 5 in which it is seen that a swinging bolster of wood is

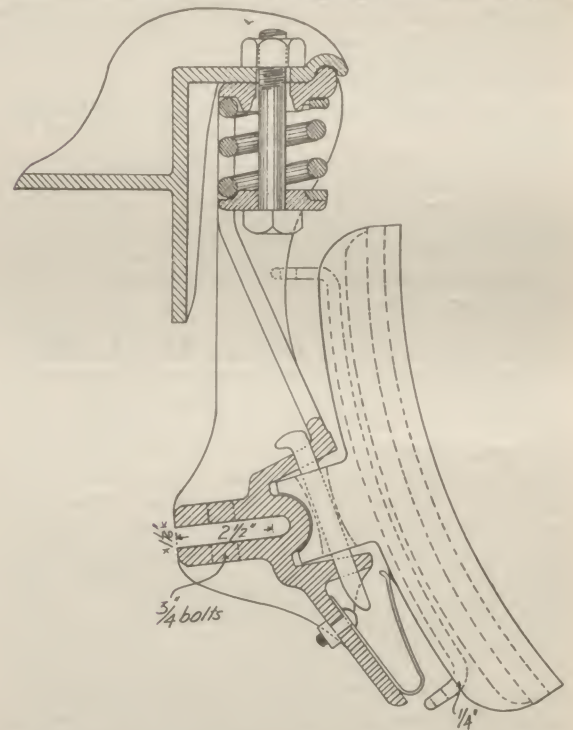


FIG. 4.—BRAKE HANGER, FULCRUM AND SHOE.

used on triplet elliptic springs. The equalizing bar receives the weight through spiral springs. This bar does not show clearly in the photograph because it is partly hidden by the side frame, but it can be distinguished by close examination as passing through holes in the inside pedestal jaws and into pockets formed in the under parts of the journal boxes. This construction admits of placing the springs at a minimum distance from the journal boxes, which is to avoid the tipping of the truck frames by the application of the brakes. The side frames are of steel, as also are the equalizers. The brake mechanism is equalized and is fitted with mas-

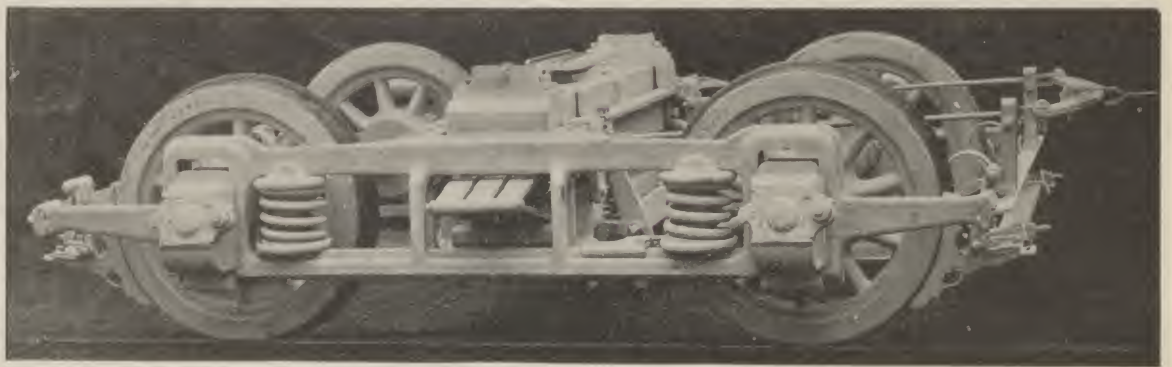


FIG. 5.—MOTOR TRUCK BY THE J. G. BRILL COMPANY.

The brake-shoes are provided with wrought iron rods, cast into them during manufacture in such a manner as to prevent the dropping down of pieces should the shoes become broken in two or more pieces. The shoes are provided with a short boss which passes into a cavity in the hanger where it is held by a short key. If this key should become loosened and lost the shoes cannot drop out because of the fact that the hangers require to be pried back from the wheels with a bar before the shoe can be introduced, or removed. These trucks have a neat appearance, and an examination of them gives an

ter car builders' standard shoes. The arrangement of the brake apparatus is so clearly shown in the illustration as to require no further explanation. The result of practical trials of these three designs will be looked for with interest, and Mr. Weston and Mr. Hedley, general superintendent, are evidently going into the question in the right way. The result of their study of the subject seems likely to be a marked improvement in the construction of trucks for electric traction.

The Western Railway Club.

Will hold its next meeting on Tuesday Feb. 18, at 2 p. m., in the Auditorium hotel, Chicago.

There will be a discussion on Mr. J. N. Barr's paper, entitled "The Ninety and Nine," which relates to the comparative amount of consideration given to big and to little things, and the interdependence of the several departments in railway service.

There will also be a discussion on "The Interchange Rules," to be based upon the club's committee report upon the Pittsburgh committee's work.

There will also be considered, at the request of the General Superintendents Association, of Chicago, the question of the disposition of journal bearings in Chicago.

The paper of the day will be entitled "Piece Work in Car Shops," and will be presented by Mr. G. L. Potter, S. M. P. Pennsylvania Railway Lines.

All members are cordially asked to attend.

The Swiss Watchmakers Journal says steel can be quite easily soldered if it is brushed with a brass-wire brush until it is yellow; the yellow part, which is really a coating of brass, then takes solder easily.

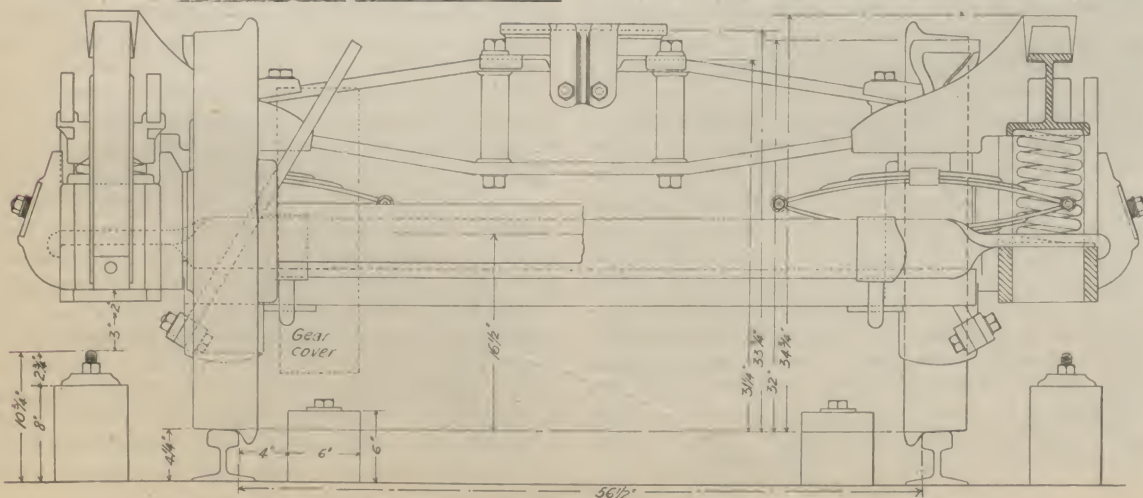


FIG. 3.—END ELEVATION AND SECT ON THROUGH EQUALIZERS.

THE RAILWAY REVIEW

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CHICAGO, SATURDAY, FEB. 15, 1896.

ADVICES from eastern and western iron and steel manufacturing centers warrant the conclusion that large requirements will be covered during the coming sixty days. A great deal of business in all furnace and mill products is being done. Favorable financial prospects have led to increased inquiry. The anxiety of producers to secure the larger contracts at this season keeps prices very low. Business is encouraging to mill men and prices under the enormous reserve capacity cannot materially advance. The weakest spot in the market is found in the fact that consumers as a rule are carrying very moderate stocks. Attention is again being directed to the probabilities of large railroad orders, but railway managers move slowly in the matter of increasing outlays except for the most urgent needs.

THE subject of interchangeable mileage tickets has received considerable attention in these columns, and although it is thought that they can be used to the advantage of both the railroads and their patrons, their indiscriminate utterance has not been advocated, but the ground taken that if issued at all they should be put forth only through the medium of traffic associations. The correctness of this position has been fully demonstrated by the use made of mileage tickets of this character issued by some of the roads in what prior to January first was known as Central Traffic association territory. It is claimed, but with what truth is not known, that some of the smaller roads are selling such tickets at reduced rate, being led to do so because of their immediate need of money, the long deferred time of payment which naturally attaches to such tickets, making the sale equivalent to a time loan payable in installments. Possibly, the fact that in the natural course of things some of the mileage slips taken up by the various railroads for passage would be lost, thereby relieving the issuing-road from liability for such coupons, has something to do with the willingness to sell on such a basis. If interchangeable mileage tickets are to be used (and there is no doubt but what there is ample justification for their use), they should be issued only by the association of which the roads in question are members. Such a plan would altogether remove the objections inevitably attaching to the sale of such tickets by individual railroads.

IN the discussions of recent designs of locomotives a great deal of prominence has been given to the comparative merits of the arrangement of fire-boxes and fire-box heating surfaces, as employed in the new Chicago, Burlington & Quincy passenger locomotive illustrated in the RAILWAY REVIEW of December 7, 1895, page 676, and that of the new standard passenger locomotive of the Chicago & Northwestern Railway, an illustration and description of which may be found in the issue of November 2, 1895, page 608. It will be remembered that there is a great difference in the sizes of the grates in these two engines, that of the Chicago, Burlington & Quincy having forty-five square feet, as against twenty-seven square feet in the Chicago & Northwestern design. An impression seems to have become pretty generally distributed that these engines differ greatly in fire-box heating surface, and that the engines are in similar service, thereby furnishing a means of satisfactory comparison of the two designs. Both of these suppositions are wrong, and it is surprising to see in a contemporary, which is almost invariably correct in its statements, a paragraph with reference to these two

engines, as follows: "The service which these locomotives have to perform is similar in kind, but it is not known now which has the heavier train. They are in fast mail service and the experience of the next few months will settle pretty definitely the relative values of the large and small grates for heavy work. One advantage which accrues to the boiler with the large grate is that there is also a larger fire-box heating surface. Each square foot of area of heating surface in the fire-box is as good as from eight to twelve square feet of heating surface in the tube." The facts are that the runs which these two types are now working are not comparable. The Chicago & Northwestern locomotive is not pulling the fast mail, and the fire-box heating surface in the two designs is practically identical in extent. The total fire-box heating surface of the Chicago, Burlington & Quincy is one hundred eighty-seven and four tenths square feet, and that of the Chicago & Northwestern is one hundred eighty-eight and one-tenth square feet. This opportunity is taken to repeat the statement made previously in these columns that the only comparison between these designs, which will be worth anything, is one made with the assistance of a stationary locomotive testing plant, and if comparisons are to be based upon the ordinary methods of comparing service on trains which are not at all similar, the results will be misleading. The comparison of the two designs involves the effect of heating surfaces differing in arrangement combined with different grate areas.

THE YARROW WATER TUBE BOILER EXPERIMENTS.

There has been considerable discussion both here and abroad concerning the merits of water tube boilers, and in England interest has centered upon the relative merits of boilers provided with outside downcomers and those utilizing steam generating tubes themselves as a medium for conveying the downward flow of the water. One or the other method is necessary in order to obtain the proper circulation, and Messrs. Yarrow & Co. are to be thanked for furnishing the practical solution of the question by a series of expensive and exhaustive experiments made at their Poplar works. The apparatus employed was very elaborate and was arranged with special reference to comparing the methods which are used in different types of water tube boilers. The tubes were mostly of glass, to enable the movements of the steam bubbles to be distinctly seen. An ingenious mechanism was devised whereby a small screw propeller was used to measure the velocity of the current.

Many different views have been advanced as to the desirability of heating the tubes carrying the downward currents, and this at first sight seems to be a very simple, easily decided question, and it would naturally be supposed that given a tube of U shape, both ends of which terminate at the top in a water drum, and below the level of the water in that drum, heat should be applied to the tube in which the upward current was desired and to that one only; also, that if heat were to be applied to the tube in which the water was passing downward in its course of circulation the result would be to retard the movement. This view is still held by many persons, but strange as it may at first seem the experiments at Poplar prove that the heating of the down legs of the tubes increases the rapidity of the circulation, and Mr. Hiram Maxim, who was associated with Mr. Yarrow, explains the result by showing that whatever retardation is caused by bubbles of steam which are derived from heating the downward tubes is exactly counterbalanced by the volume which they add to the steam in the pipes which are leading upward in the circulation. This explanation seems to be entirely satisfactory, and it would be natural to expect that heating the downward current of water, beside forming bubbles in the downward passage, would raise the temperature of the water in that leg to a sufficient extent to render but little additional heating necessary in the upward tube in order to very greatly increase the proportion of bubbles formed in the upward course.

If the downward tube is not heated there are no bubbles of steam whatever in it, neither will there be any at the bottom of the up-tube, and the circulating force will be diminished with only one leg heated. These experiments were nearly all conducted at atmospheric pressure, but one which was carried on at over one hundred pounds per square inch confirms the theory. It therefore may be safely accepted as a fact that it is advisable to heat both tubes. This, however, may be carried out to an unreasonable extent, because it is possible to heat a U-tube to such a degree as to form steam in both legs and obtain no circulation at all. This, however, would not occur in practice, except with dangerous

forcing of the boiler. It is regretted that space enough to properly describe these tests in detail is not available, for though they were not intended to exhaust the subject entirely, they serve to show that some pretty generally accepted ideas about circulation in these boilers are erroneous.

Another exceedingly interesting experiment was performed at this time by Mr. Yarrow, who wished to determine the relative merits of straight and curved water tubes with reference to leaking caused by expansion and contraction. The tubes in the Yarrow water tube boiler are straight, and it has been considered remarkable that they have not given trouble by leakage at the tube sheets. By arranging rods in the tubes so that the relative lengths of the tubes containing water only, and those containing water and steam could be measured it was ascertained that so long as good circulation existed there was no possible objection to the use of straight tubes, and Mr. Yarrow came to the conclusion that there was no more reason to curve them than to curve the fire tubes of the locomotive boiler, and owing to the care with which this test was made, it seems safe to say that for all practical purposes the temperature of all tubes may be considered the same as that of the water which they contain. In regard to the merits of the Yarrow type of boiler it is stated in *Engineering* of London that one of these boilers on one occasion was known to be subjected to such rough treatment by forcing as would have certainly set the tube plate of a locomotive boiler leaking like a colander, but without causing any damage. These tests go a great way toward showing that perhaps the application of water tubes to locomotive boilers may be successfully accomplished, and if they can be made straight without danger from stresses from expansion and contraction the difficulty of construction of such a boiler would be greatly reduced.

FREE TRANSPORTATION.

The question of free transportation and the limitations which should be imposed thereon is one of recurring frequency, and one which, although from time to time is alleged to be finally settled, does not stay settled. The difficulty lies in determining where the limit shall be drawn, a difficulty that will probably remain so long as the issuance of free transportation requires the drawing of such a line. It would probably be for the welfare of the railroads if all tickets for transportation over a railroad were required to be paid for, regardless of the character or connection of the person using them; but that, under our present system is perhaps not possible, and for some years to come at least exchange passes, as well as those given for a consideration, in the way of advertising, or settlement of claims, will continue to be used. It is, however, evident that the lines are narrowing, and that it is coming to be more generally understood that the days of the issuance of promiscuous free transportation are of the past.

The lengths to which some persons of acknowledged respectability will go to obtain free transportation, are a constant source of wonder to railroad officials. Nor is the practice confined to any particular class of individuals. It will be recalled that this year the issuing of the clergyman's half fare permits was committed to the chairman of the Western Passenger Association. This of course had the effect of concentrating the applications of the entire western clergy in one office, and it is to be feared that if the persons directly charged with the issuing of these permits had a very exalted opinion of the ministerial individual, it has suffered a serious collapse, and they have learned that preachers are very much like other human beings, in some cases considerably more so. The attitude assumed by many of these gentlemen is no doubt the result of ignorance, but their desire to obtain something to which they are not entitled, is very much and too frequently in evidence. It should be said, however, that they are not in the majority, but are exceptions to the rule.

The latest manifestation of this desire to obtain free or reduced rates transportation comes from an unexpected source; and is of a character little calculated to add to the estimation entertained by many railroad men of the higher class of educators in this country. So general has been the request for such favors from the heads of the higher institutions of learning as to almost indicate a concerted movement on the part of these gentlemen in this direction. Nor is the reason assigned as justifying the request, the least novel feature of the case. It is stated in terms that they possess facilities for influencing, and to some extent controlling, the routes by which students travel to and from the institution, and in time, if they do not actually state, that this influence will

be used to the detriment of the particular railroad communicated with unless their request is granted. Inasmuch as in many instances such requests were sent to all of the roads that could by any possibility serve the institution in question, one of two things is evident; either no influence in favor of any particular road was intended to be exerted, in which case the application was dishonest; or else it was supposed that some road would be weak enough to break its agreement, and enter into a dishonest compact with the applicant. It was not known by the applicants that all such communications would be referred to a single authority, thereby affording a means of comparison, but such is the case.

The serious aspect of this whole matter is the apparent willingness with which men who are set for the training of young people, and are thereby largely responsible for the moral character of successive generations, should be willing to engage in an open violation of the law for the sake of slight personal gain. The only persons to whom free or reduced rates can be issued under the law, are destitute and homeless persons transported by charitable societies and municipal governments, together with the necessary attendants, ministers of religion and the inmates of the various homes for soldiers and sailors and their dependents. All others are under the law required to be treated upon a common basis, and it is difficult to see upon what ground educators can claim lawful exemption from its operation. Nor is the effect of such, and kindred examples a question of theory. One of the most prominent business men in Chicago recently gave it as his deliberate conviction that the standard of business integrity in this city, as well as throughout the country, was steadily declining—a result not to be wondered at when disregard for law is becoming so prominent a feature in the commercial and social life of our citizens. It is of paramount importance that our educational institutions should stand for the highest morality, in order that their influence may help to stem rather than add to the tide that now seems to be setting toward a degree of laxity of moral integrity that is as dangerous as it is disgraceful.

AIR BRAKES ON ELEVATED ROADS.

On another page of this issue will be found an illustration of the air compressor used upon the Metropolitan Elevated Railroad of Chicago, which, as is well known, is an electric road, and accompanying it is a brief description of the method of braking employed together with some notes from officers of the road and the manufactures of the brakes stating the reasons for the selection of this form of apparatus, for the purpose of showing that in the minds of the officers who selected the brakes there were definite reasons for their action. The subject has recently been brought to the notice of the public through reports of a slight accident upon this road in which a motor car ran past a terminal station at too high a speed, and breaking down the bumping post at the end of the track ran off the end of the structure into the street, injuring the motor man and conductor. There was also another slight accident of a similar nature occurring at about the same time, and for which, like the one mentioned, the brakes were not in any respect responsible. These were merely cases in which the brakes were not applied at all until too late for any brake to do any good. The accidents merely bring up the subject of air brakes for elevated railways, and as the increase in this form of transportation is probably to be great in the near future, it seems appropriate to consider the different systems of brakes used for stopping trains on elevated structures. There are widely differing opinions held by the officers of elevated roads as to the form of brake best adapted to that service, and some of these men, particularly those who have not gone through the mill upon surface steam roads, consider that the conditions under which they work are so different from those existing upon large steam roads as to require very different treatment of the brake question. The conditions certainly are different in the two cases as it is not necessary upon any steam line, so far as is known, to make stops at intervals of about two minutes, to spend say, only fifteen seconds standing still at a station and to stop at the station within definite limits about five feet apart. Also two minute headway upon a steam line is extremely rare.

It is not the purpose of these paragraphs to adversely criticize methods of braking upon elevated roads, nor to express preference for any particular system, but merely to show the differences of opinion which exist among the men who are handling this special traffic. It is not supposed that any railroad man in this country, at least, will be willing to

see any retrogression from the present advanced state of the art of braking upon steam surface roads. In other words a change from the automatic quick action brake for such service is not to be considered. The automatic feature of continuous brakes needs no champion, as everybody desires this element in a brake, and even those who are not using it upon elevated roads admit that they would like to have its protection. The reason advanced for not using the same form of apparatus employed upon larger roads is that easier and smoother stops may be made with a brake that may be applied with a maximum pressure at first, and the pressure gradually reduced as the speed diminishes, which when handled with even a small amount of skill produces a stop with the minimum of jar or jerk. This is the mainstay of the argument for the use of vacuum and straight air types of brakes, and, as stated, while the men who select these forms consider the automatic feature desirable, they consider that the comfort of the passengers all the time is to be preferred to less comfort and greater safety, and one managing officer of an elevated road in Chicago admits that he does not anticipate any trouble from trains breaking in two.

On the other hand men who are using the automatic quick-action brake on similar service would not do without it under any consideration. They succeed in getting fairly smooth stops within the limits mentioned, and believe that by careful instruction of the men and watchfulness to see that they do not become careless, there is no reasonable ground for complaint, although these officers, as a rule, admit that easy stops alone considered, the advantage lies with the straight air or the vacuum brake. To determine positively on this point a number of trips were made upon three roads using respectively the automatic quick-action, the vacuum and the straight air brakes in order to determine the actual comparison between the stops which were being made upon each. It is not thought that the employees using either the vacuum or the straight air brakes were superior to those handling the automatic, but rather the reverse. Yet in these cases there was a decided difference in favor of the two former in the smoothness of the stops. The question resolves itself into a simple proposition as to whether a slight but continuing difference in the comfort of the passengers is to be preferred to the additional safety provided by the automatic feature. This is a question which we do not attempt to decide, but it is significant that a road in Chicago now equipped with the vacuum system, and having had about two years' experience with it, is contemplating a change to the automatic. On the other hand, on a neighboring road which was being equipped with the automatic system the officers decided to change to the straight air brake. This was done, however, before the automatic was put into regular continuous service. There are several other questions intimately connected with braking of elevated railroad trains which ought to be discussed here, among which is the advisability of having more than one man at the head end of each train, and this matter is one which should be considered before going too far in the equipment of new roads, especially those upon which electric traction is contemplated.

SHOP NOTES—GREAT NORTHERN RAILWAY.

The first thing to attract attention in a recent visit to the St. Paul shops of the Great Northern Railway was a set of cast iron truck boxes which were undergoing grinding on the bed of an old planer. The boxes were bolted down upon the platen of the planer and the side faces were dressed off to a smooth surface by an emery wheel of about 12 in. diameter which was mounted upon the tool head. The bearing faces were chilled and were therefore too hard for any steel tool. The boxes were not tooled or finished anywhere except upon the wearing surfaces where they come into contact with the collars and the wheel hubs, all other surfaces including the inside bearing surfaces for the brasses, were rough. The fit for the brasses is obtained by means of a lead shim about $\frac{1}{4}$ in. in thickness into which the brasses press and which form seats by yielding to the pressure occasioned by unevenness in the castings until a firm bearing is obtained. The whole expense of preparing a box for the brass is about ten cents, and as the work which is done is rough, it is performed by comparatively inexperienced help. The chilled faces give excellent wearing surfaces and it is said no trouble is found in finishing them in this way.

Considerable attention has been paid in these shops to reduce as far as possible the amount of labor in fitting up castings. For instance, the inside surfaces of the bull rings for pistons are left in the rough, as the castings come from the sand except in case bunches are found. These are cut out by a

coarse roughing cut. Mr. Pattee believes thoroughly in the merits of the milling machine. A horizontal boring mill was pointed out which was apparently used as a milling machine for boring out driving box brasses. Another interesting machine seen was a lathe employed in turning up piston packing rings. The rings were cut from a cylinder as usual, but this cylinder was turned up upon the inside and the outside simultaneously by two separate tools which were held in a U-shaped holder, which had the arms prolonged sufficiently to give the necessary reach to the tools. The holder had a stem extending from the curved portion, which was secured in the tool rest of the lathe. Another tool holder was arranged for this machine which had a half-dozen slots near one end into which cutters could be secured so as to take both roughing and finishing cuts over the rings at one setting and with one feeding across the work.

Another use to which milling cutters were put was to finish off the seats for the lids of journal boxes for passenger and tender trucks. The surfaces are thus left very smooth and a tight fit of the lids is assured. Among the interesting devices seen in the car shops was an ingenious pneumatic apparatus used for pressing air hose couplings into the ends of hose. This consisted of a clamp to which the half coupling was secured by a simple movement and the hose was held by a long sleeve made in halves which inclosed the hose and held it securely. This hose clamp or sleeve was mounted upon the end of a piston rod of an air cylinder 5 in. in diameter having sufficient stroke to press the hose onto the shank of the coupling by an ingenious cam, operated by the piston rod spoken of, the clamp ring was pressed into position ready for the bolt to be passed through its lugs. Thus by two movements of the air piston the hose was pushed over the coupler shank and the clamp applied with no manual labor whatever. This road has a well equipped and well arranged air brake instruction car in which the apparatus is placed at the sides giving ample space for a class to see an examine it readily.

The elaborate system of locomotive rating recently described by Mr. Henry H. Vaughan, mechanical engineer of the road, before the Northwest Railway Club, is being carried out nearly as described in the paper, an abstract of which appeared in the RAILWAY REVIEW of January 25, page 46. This has been found to be highly satisfactory in practice, and the results in decreasing the cost of handling freight as based upon ton mileage has been marked, showing the value of the method. The plan of comparing service upon the ton mileage basis is firmly established upon this line, and the system of discipline without suspension is being rapidly extended. This is specially true of the operating department, and it was stated that for the past six months there had been no men taken out of service on the westernmost one thousand miles of the road.

ABOUT ADVERTISING.

There is an uncommon amount of common sense in the practical hints on advertising now being published regularly in the department of this paper headed "For the Publisher," says the Northwestern Lumberman. Advertising is the most important part of every business under the sun. There is no question about that. And still it is the most generally neglected. No man can do business without letting people know in some way or other that he wants their trade. He can stand on the top of his factory, machine shop or lumber pile, swing his arms and yell—that is advertising—but he had better go about it in a surer way.

There is a best way to do everything; there is a best way to advertise. No one plan will fit all cases. The business ought to fit the advertising and the advertising to fit the business. The practical hints alluded to are written by Charles Austin Bates of New York, a man who has had many years of active, actual experience in all the different kinds of advertising. Among advertisers generally, big and little, he is perhaps as well known as any other man in the United States. What he has to say is marked by plainness and direction. He tells what he knows rather than what he thinks. His talks are thoroughly practical, and it is pretty safe to say that the man who faithfully follows his advice will get better results from his advertising.

In this connection it may be pertinent to remark that at no time in the history of the Northwestern Lumberman have its advertising pages attracted such widespread attention as at the present time and for the past few months. The Lumberman has made a new departure in advertising; has marked a new path in the manner of presenting the claims of its advertising patrons to its readers, whether they be lumber dealers or saw mill operators. The result of the new departure is to make the Lumberman's advertising pages read as carefully and as regularly as its news or editorial pages. The Lumberman contends that there is news and information to be gained from its advertising pages, and sometimes entertainment as well. The lumbermen who advertise are the live, up-to-date lumbermen who believe in hustling for trade and not in waiting for trade to come to them. They know that more buyers of lumber in

this country look over the pages of the Northwestern Lumberman than any other journal, and they have been quick to realize the importance of the departure in the Lumberman's manner of presenting their announcements.

One thing ought to be borne in mind and given serious attention by those lumbermen who wish to extend their trade. A weekly advertisement in a journal like the Northwestern Lumberman is like having a traveling salesman on every railroad in the territory where trade is solicited at the same time. We do not pretend to argue that the advertisement should take the place of the traveling salesman so long as that is the method adopted for selling lumber. As a method of attracting attention: of making yourself known; of keeping your name and the particular lumber you sell always before the buyer with a force that is widespread and cumulative, advertising stands alone. It is the only way in which such results can be accomplished. We have known people to vote advertising a failure because they did not receive orders for whole train loads of lumber as the result of the insertion of an eighth page card for two or three months. It must be a very large and a very expensive advertisement that could not be considered profitable if it secured to you one good customer during a year. Much of the value of advertising lies in the persistency with which it is conducted. To stop advertising is, in the language of Philadelphia's greatest merchant, John Wanamaker, equivalent to "taking down your sign."

How many manufacturers or wholesalers of lumber ever stopped to consider how little advertising they really do, when the volume of their business is compared with that in other lines wherein advertising is considered not only the proper, but the profitable thing to do? Well posted advertising agents assert that the average business man who advertises calculates to spend not less than two per cent of his gross sales in advertising. The Royal Baking Powder Company spends every year for advertising an amount equal to 12½ per cent of its gross sales for the preceding year. This is probably the most conspicuous example of persistent, systematic and profitable advertising in the world. The great department stores in Chicago, of which the Fair, for instance is a good example, spend half a million dollars annually in advertising. The lumberman who sees bankruptcy in a proposition to spend \$250 for that purpose in a whole year ought to ponder these figures and see if it would not be profitable after all to alter his point of view.

The hints referred to are as follows:

PRACTICAL HINTS ON ADVERTISING.

Copyrighted.

The science of advertising is in its infancy. It is growing in importance and efficiency every day. It used to be a speculative venture—now it is a scientific certainty.

No man has reached the acme of business success. Hights that we do not dream of will be attained by twentieth century merchants. I am one of those who believe that there is no limit to the possibilities of human achievement.

One man succeeds and another man fails, and people wonders how it happens. It seems sometimes to people who do not think deeply that the weaker duller man goes ahead, and that his more brilliant brother sticks in the rut at the first round of the ladder.

Slight differences in men seem to make all the wide differences between success and failure.

In games of chance (?) the "bank" has only a slight percentage, but the bank always wins.

Back of every result is a reason. Back of business success are earnestness, energy, persistence, concentration. Between these and achievement is advertising.

No man ever yet made a success of business without advertising of some sort. Maybe he didn't call it advertising, but it was advertising just the same.

Advertising primarily consists in letting a lot of people know you are in existence and what excuse you may have for it.

When a man goes into business he has some cards printed, and when he meets an acquaintance thereafter he pokes out a card and says: "When you're down my way, drop in." That's advertising.

The trouble is that you can't repeat that operation often enough—personally. What you can do is to put the card and the remark, more or less elaborately expressed, into a paper, and have it handed to thousands of people all in one day.

Save your money on your advertising if you can, of course but save it in the right way. Cut off the little leaks—the programs, the bills of fare, the directories, the wall charts, the pages in "souvenirs" Cut them all off and your trade won't ever feel the difference. Cut off the inconsequential papers if you have to, but always keep your ad in the best papers big enough to do you justice. It is better to convince a few people than to talk to many.

You will always find that the best papers give you more for the money than any other media. It costs more in proportion to produce 500 circulation than to produce 5,000.

Don't think one paper high priced because the rate is a dollar an inch, and another one low priced because it is ten cents an inch. Usually the more you pay for advertising the cheaper it is. There are exceptions, of course—they prove the rule.

Economy often defeats its own end. Sometimes economy is extravagant. Sometimes not spending is more expensive than spending. So in advertising. That is an economical expense. I call it an expense to avoid argument. It is really an investment.

In a ten dollar advertisement, the last two dollars pay better than the other eight. Maybe an eight dollar ad wouldn't pay when a ten dollar ad would. Maybe that extra space is just what the ad needs to lift it out of oblivion—to make it prominent—to make it pay.

Don't buy more space than you need, but don't buy too little either. Better buy too much than too little. Better put an eight dollar ad in a ten dollar space than to put a ten dollar ad in an eight dollar space. One way you are out only two dollars: the other way you are out eight dollars.

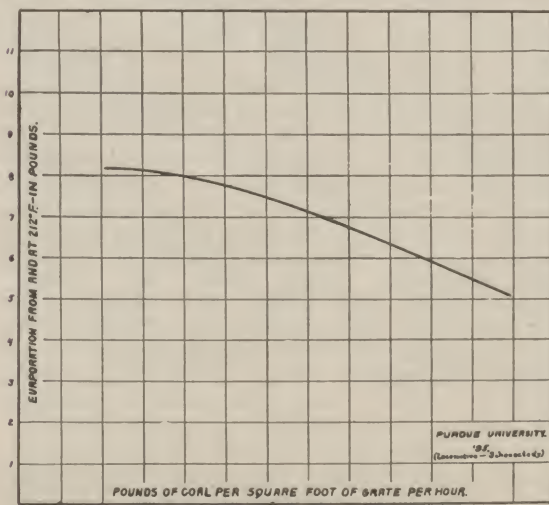
The nucleus of advertising is a sign over the door. If nobody had ever put up a sign, the Royal Baking Powder Company would not now be paying \$800,000 a year placing signs in all the newspapers of America.

And now an instance of how not to advertise. George Blackburn, chief clerk in the Chicago, Burlington & Quincy general freight office, tells the following true story: A certain gentleman had been favoring the "Q" with his business for a year or more, when it was noticed that his shipments suddenly ceased. A freight solicitor called to ascertain the reason, and found the shipper in a highly indignant frame of mind. "No, sir," he said, "not another pound. Here I've been giving you fellows practically all my competitive business for the last year, and what do you do in return? I spent \$30,000 on a house near the lake shore so that I could get a view of the lake, and about a week ago a gang of carpenters came along and built a bulletin board 20 ft. high and 3,000 ft. long between my house and the lake, completely shutting off the view, and the next day there was a sign on it, 'Ship your Freight by the Burlington.' I was shipping my freight by the Burlington, but if you fellows didn't know it—as the sign would indicate—I'll not do it any more."

GRATE AREAS AND HEATING SURFACES.

Writing to the Railway Master Mechanic Prof. Goss of Purdue University presented a diagram showing the relations between the rate of combustion and the boiler efficiency of the locomotive at that university. This communication was called out by the article which we reproduced in our issue of January 4, page 2. He says:

It will be seen that when the rate of combustion is 30 lbs. per square foot of grate surface, more than 8 lbs. of water are evaporated per pound of coal, while if the rate is increased to 180 lbs. the evaporation falls to about 5 lbs. The diagram shows the rate at which the efficiency diminishes as the boiler is forced to give increased power. For reasons which have already been discussed* the diagram cannot be used with certainty as a means to the solution of the grate area problem, though to those familiar with the performance of locomotive boilers, it



will prove suggestive and interesting. It shows the sum of two effects, namely, the effect of change in the rate of combustion, and the effect of change in the volume of heat passing the boiler which is a result of the first change. How much of the observed change is due to the action at the grate, and how much to the action along the heating surface, cannot be determined from the diagram.

The precise effect upon the efficiency of any specific change in the proportion of a boiler can only be determined by a series of experiments in which all factors are maintained constant, except the one under consideration.

*Proceedings Western Railway Club, Nov. 1895, p. 119;

With all other factors constant, the single variable may be changed for each test and the effect noted. With this principal in view, a series of tests has been outlined, and is now in progress at the laboratory of Purdue University, which it is hoped will aid in the solution of the grate area problem. A few facts from this outline may be of interest.

The important constants for the series are:

Quality of fuel (Brazil block.)

Pounds of fuel fired per hour.

Boiler pressure.

Cut off (about 5 in.)

Throttle (full open.)

Each test will be different from the others by the extent of effective grate area. The effective area of the grate will be varied by use of brick deadening, to give rates of combustion of from 50 to 200 lbs. of coal per hour per square foot of effective grate. The draft conditions for each test will be made such as may be required to burn the predetermined weight of coal. It is to be noted, that the boiler only is under test. The engine will utilize the steam generated, its action will shake the boiler, and its exhaust will supply the draft. Its speed will be approximately 25 miles per hour, but this may vary slightly with different tests, the purpose being to have the total weight of fuel burned the same for all tests.

The observed data as provided for by the outline, includes weight of coal, weight of ash, weight of sparks in smoke box, weight of sparks passing from stack, draft smoke box temperature, water and steam, coal samples for analysis, spark samples for analysis, and smoke box gases for analysis.

The results of these tests should show whether for the quality of coal used, there is any one rate of combustion between 50 and 200 lbs., which is more efficient than other rates, and the completeness of the observed data also should permit a careful analysis of the furnace action as a whole.

Another writer contributed the following:

As possibly throwing some light on the subject of grate areas and heating surfaces, discussed editorially last month, I quote below some figures obtained in a freight service test with dynamometer car, weighed coal, etc., which I made in 1894:

Engine	A	B	C
Style	2 Cyl. Comp. Simple	10-Wheeler	Mogul. Consol.
Diameter of boiler	58 in.	60 in.	60 in.
Grate area, square feet	31.3	31.5	34.7
Heating surface in square feet:			
Tubes	1,756	1,555	1,391
Fire-box	172	136	164
Total	1,928	1,691	1,555
Miles on present flues	1,000	5,941	42,231
Miles on present fire-box	1,000	56,526	150,353
Combustion	91.7	87.9	65.5
Evaporation	6.64	6.67	7.49

"Combustion" is the pounds of coal burned per square foot of grate per hour. "Evaporation" is from and at 212 degrees.

I have calculated the pounds of coal burned per hour per square foot of heating surface for each of the three engines. That, together with the rate of combustion and evaporation is given in the following table:

Engine	A	B	C
Pounds coal per square foot heating surface per hour	1.49	1.64	1.46
Combustion	91.7	87.9	65.5
Evaporation	6.64	6.67	7.49

Because of the difference in the proportion between the fire-box and flue heating surface in the different engines, and because we do not know certainly the relative efficiencies of these two heating surfaces, the above figures probably do not prove anything conclusively. But taking into consideration the fact that the heating surfaces, or rather the heat absorbing surfaces of engine C were more heavily coated with scale than those of either of the other engines, it seems to me strong presumptive evidence that the rate of combustion had more influence on the evaporative efficiency than the ratio between the combustion and the heat absorbing surfaces. On the other hand, if your contention is based on good grounds I should say that the ratio between the pounds of coal burned per hour and the square feet of heating surface should have a greater influence on evaporation than the rate of combustion on the grate.

STATIONARY BOILERS AND SOFT COAL BURNING.

The following concise statement of the requisites for efficient, economical and smokeless combustion of soft coal under stationary boilers has just been received from Mr. C. M. Higginson of the Chicago, Burlington & Quincy Railroad. This constitutes a formula which has been found to be satisfactory and when the size of boiler required is known the other data for the design may be worked out. Mr. Higginson has had marked success in applying his ideas in practice and the proportions given may therefore be taken as the results of careful experimenting which give a proper and reliable precedent.

1. Ample draft. To be not less than ½ in. of water on draft gage.

2. Open grates. The openings to be fully one-half the grate area.

3. Air admission over the fire. The openings to be from ⅓ to ⅔ of the grate surface, according to the rate at which coal is burned.

4. Perfect admixture of the air and coal gases.

5. Flamework sufficient for combustion to be completed. This will call for from 15 to 20 ft.

6. Heating surface in the flues and boiler shell to be at least 50 ft. to each square foot of grate, and to be over 55 ft., with draft of one inch, or more.

Mr. Higginson says that the first five items if complied with, will give good performance as regards smoke, but that all six are needed to get the

best results from fuel. Also any device that meets all the above requirements will give good results, and should show an evaporation of 9 lbs. water at 212 deg., with Streater or Wilmington coal and that no device not meeting the above requirements will the best results which may be obtained.

PERSONAL.

Mr. Charles T. Hancock has been elected president of the new Dubuque & Pacific Railroad Company.

It is reported that Mr. F. D. Adams has resigned as master car builder of the Boston & Albany Railroad.

Mr. T. E. Russell has been appointed traveling freight agent of the Canadian Pacific Railway vice Mr. S. S. Renshaw.

Mr. Edwin C. Hiser has resigned as master mechanic of the New York Central and Rome, Watertown & Ogdensburg roads.

Mr. W. R. Satchell has been appointed assistant master mechanic of the Wheeling & Lake Erie with headquarters at Norwalk, O.

Mr. Amos Paul, who has been a director of the Boston & Maine for 25 years, died at Exeter, N. H., a few few days ago, age 85 years.

Mr. C. M. Wilson of Pecos, Tex., has been appointed superintendent and auditor of the Pecos River Railway with headquarters at Eddy, N. M.

Mr. E. M. Roberts has been appointed master mechanic of the Southern Iron Car Line with office at the shops of the company at Atlanta, Ga.

Mr. Arthur M. Parent heretofore assistant manager of the Pullman shops, has been made manager of the works vice Mr. Harvey Middleton recently resigned.

Messrs. Samuel M. Inman and George W. Maslin were on Feb. 10 elected directors of the Southern Railway to succeed Messrs. Ryan and Thomas, resigned.

Mr. Tillinghast, who was in December appointed assistant general freight agent of the Big Four has resigned, and will go with Mr. Oscar G. Murray to the Baltimore & Ohio.

Mr. H. A. Callan, who has heretofore represented the Damascus Bronze Co., and the Latrobe Steel Co. in the west, has resigned the former agency and will represent only the Latrobe Co.

President E. H. R. Green has appointed Mr. A. P. Gorman, formerly general manager of the Waco & Northwestern Railroad, superintendent of the Texas Midland Railroad, effective March 15.

Mr. Henry Van Gorder has been appointed track supervisor of the first district of the Cleveland, Cincinnati, Chicago & St. Louis with headquarters at Wabash, Ind. vice Mr. R. Melrose resigned.

Mr. Jasper Jennings has been made supervisor of bridges and building, of the Cleveland, Cincinnati, Chicago & St. Louis Railroad with headquarters at Wabash, Ind., vice Mr. William Green resigned.

Mr. George S. Fowler, of Ft. Wayne, Ind., who has a large acquaintance among the railroad trade, has accepted a position under the new management of the Kalamazoo Railroad Velocipede & Car Co. as its traveling sales agent.

Mr. Sumner P. Hopkins, who has had over thirty years' experience in railroad work, a great deal of which time has been in the employ of the Wabash, will soon assume the title and duties of commercial agent of the Grand Trunk.

Mr. William Davis, president of the San Antonio & Gulf Shore Railway has resigned and with New York capitalists will, it is announced, build a line east from San Antonio which will shorten the distance to New York 200 miles.

According to official announcement Mr. F. C. Smith, has been appointed superintendent of the western division, lines west of Missouri river, of the Chicago, Rock Island & Pacific Railway with headquarters at Colorado Springs, vice Mr. R. B. Agnew, resigned.

Mr. A. G. Blair, a prominent railroad and coal man of Toledo, Ohio has been elected president of the Wheeling & Lake Erie road by the directors of that company. His selection as president of the road is said to be looked upon with much favor by all interested.

Mr. C. V. Lewis who has had charge of rates and tariffs on the Cleveland, Cincinnati, Chicago & St. Louis, and is considered an expert in his line, has resigned that position to be effective Feb. 15. It is said that Mr. Lewis will accept service with Vice President Murray, of the Baltimore & Ohio.

Mr. F. W. Brazier, formerly superintendent of the Chicago New York & Boston Refrigerator Co. and who is located at Elsdon, Ill. has just been appointed general foreman of the car department of the Illinois Central Railroad and will have charge of all of the car work at the new shops at Burnside.

Freight Traffic Manager W. P. Walker of the Chesapeake & Ohio has been appointed by President Ingalls a member of the Joint Traffic Association board of managers. Mr. Frank M. Whittaker, manager of the Kanawha dispatch becomes general western freight agent of the Chesapeake & Ohio.

Mr. Clarence S. Bement, of Bement, Miles & Co., of Philadelphia, who has an exceptionally fine mineralogical collection, has been awarded a silver medal by the Royal Academy of Sciences at Munich, Germany, as a recognition of his work for the advancement of the science of mineralogy.

Mr. G. M. Reid, superintendent of bridges and buildings of the Lake Shore & Michigan Southern Railway, died very suddenly at his home in Cleveland on the 10th inst. Mr. Reid was born at Canandaigua, N. Y., on March 9, 1832, and entered railway service in 1872, with the Lake

Shore road, in the same position he held at the time of his death.

Mr. W. J. Sherman of Norwalk, O., has been appointed chief engineer of the Wheeling & Lake Erie with headquarters at Toledo, to fill the vacancy occasioned by the resignation of Chas. A. Wilson. Mr. Sherman is an engineer of large experience both in the maintenance of railways, railway structures and docks, and has occupied several important positions during the past 10 or 12 years. The selection by the Wheeling company seems to have been carefully and wisely made.

Mr. A. W. Warnock who has had charge of the advertising department of the general passenger department of the Chicago, St. Paul, Minneapolis & Omaha for nearly four years has severed his connection with that company to accept a position in the business department of the Minneapolis Journal. He will take a short vacation before entering upon his new duties. Mr. Warnock was in the newspaper business before he entered upon railroad work, and since he has been connected with the Omaha road has made many friends in railroad circles, who will all wish him well in his new work.

Mr. R. D. Wade, who for fifteen years has been superintendent of motive power of the Richmond & Danville and since the consolidation with the Southern Railway of the whole system has resigned that position. Mr. Wade entered railway service in 1857 as machinist in the shops of the Alabama & Tennessee River road at Selma, Ala., going the next year to the Greenville & Columbia, on which road he occupied various positions until 1876, when he went to the Richmond & Danville as master mechanic, being promoted to his present position in 1881.

Mr. John W. Loud, of Detroit, has been named for the position of general freight agent of the Grand Trunk Railway, and General Managers Hays' circular announcing the appointment will be issued accordingly. Mr. Loud's jurisdiction will extend from the seaboard to the St. Clair and Detroit rivers. Mr. Loud has been traffic manager of the Detroit, Grand Haven & Milwaukee, Toledo, Saginaw & Muskegon and commercial agent of the Grand Trunk. He is a railroad man of ability and experience.

Mr. Jeff N. Miller, general manager of the Pecos Valley road, at Eddy, N. M. has tendered his resignation to take service elsewhere. Mr. Miller was for many years a resident of Dallas, having been connected with the Texas & Pacific in many ways, lastly as private secretary and assistant to General Manager Grant. When Mr. Grant went out of office in 1891 Mr. Miller went west and in a short while became general manager of the Pecos Valley road, which has more than doubled its mileage and business under his term of office.

Major A. G. Postlethwaite, formerly with the St. Paul & Northern Pacific Railroad Company and general land agent of the Northern Pacific Railroad, has been elected vice president and a director of the J. C. McNaughton Company, wholesale dealers in lumber and railroad ties, of Philadelphia, to succeed Mr. Louis C. Maus, recently deceased. Major Postlethwaite, in connection with Mr. J. C. Naughton, established the business of the J. C. McNaughton Company in 1868 and now returns to his original business, after nearly 30 years of railroad service.

Mr. T. R. Foster who has for a number of years been connected with the mechanical department of the Chicago, Burlington & Quincy Railroad in the mechanical engineer's department at Aurora, and assistant master mechanic at Galesburg and also as a division master mechanic on the Burlington & Missouri River Railroad in Nebraska, has been appointed mechanical engineer for the Denver & Rio Grande Railroad in the office of the superintendent of motive power at Denver, Col. Mr. Foster takes with him the good wishes of many friends, and he is well equipped in experience for the position for which he has been selected.

Mr. John Crampton, general eastern agent of the Michigan Central with headquarters at Buffalo, N. Y., died in this city last Monday. Mr. Crampton was well known in railroad circles and had been in his present position since 1904. His first railroad work was in 1856 for the Great Western Railway of Canada with which company he held various positions. In 1878 he became general western agent (foreign freight) of the Vanderbilt lines of Chicago. He acted in this capacity until 1883, when he was appointed general eastern agent of the Nickel Plate line at New York, going from that position to the one occupied by him at the time of his death.

An official circular announcing the following appointments on the Chesapeake & Ohio road has been issued by President Ingalls, all changes effective Feb. 15: W. P. Walker, Jr., is appointed freight traffic manager, in charge of all freight traffic and seaboard coal, reporting direct to the president; headquarters, No. 362 Broadway, New York. F. M. Whitaker, assistant freight traffic manager, headquarters at Cincinnati, O., in charge of all eastbound freight traffic and export and import business through Newport News direct; also of the local road and branches and the territory from Cincinnati to the Big Sandy river, reporting to the freight traffic manager. A. G. Troup, assistant freight traffic manager, headquarters at No. 362 Broadway, New York, in charge of the eastern territory north of the Potomac river, and of all westbound business therefrom, and to assist the freight traffic manager in general duties, reporting to the freight traffic manager. E. D. Hotchkiss, general freight agent, headquarters at Richmond, Va., in charge of Virginia and West Virginia and the southwestern territory, and of all the westbound business therefrom, and of the local road, branches and territory east of the Big Sandy river; also of the tariff and claim department, reporting to the freight traffic manager. Don Alexander, assistant general freight agent, headquarters at No. 352 Fourth avenue, Louisville, Ky., in charge of Louisville and the south and southwest and the local road and the territory Louisville to Ashland, Ky., and the Ohio & Big Sandy Railroad, reporting to assistant freight traffic manager at Cincinnati. Charles L. Brown, general agent, headquarters at Lexington, Ky., in charge of Lexington and Central Kentucky, reporting

to the assistant general freight agent at Louisville. G. W. Benjamin, coal and coke agent, headquarters at Cincinnati, O., in charge of all westbound coal and coke business, reporting direct to the president.

RAILWAY NEWS.

Abbeville & Waycross.—The extension which is being built to the Abbeville & Waycross, extending from Lula-ville to Fitzgerald, the grand army colony town, is now nearly completed and the first train was run over the road last week. The new line, which has been pushed rapidly since coming into the control of the Georgia & Alabama, will give Fitzgerald direct communication with all northern and southern points by way of either Savannah, Atlanta, Montgomery or Tifton.

Boston & Maine.—The great increase in the volume of business transacted at the Boston city ticket office of the Boston & Maine R., has necessitated an enlargement of quarters, and after February 1, the commodious offices at 322 Washington street, at the corner of Milk street, and opposite the Old South Church, will be occupied as its city ticket office. The location is the one for a long while used by the N. Y. & N. E. R. R., but the renovation which has been going on for the past month has greatly transformed its appearance. The alterations and additions that have been made will now make the office of the Boston & Maine system the largest and most convenient in the city. The appointments are of the latest and most improved order, and are especially designed to facilitate and expedite the prompt transaction of the business demands of the many patrons of the road.

Brainerd & Northern Minnesota.—In 1895 this company built 9 miles of track in addition to the main line, and also 45 miles of branch line for temporary use in reaching the timber lands. The lower branch of congress has passed a bill granting this company right of way through the Leech Lake and Chippewa Indian reservations in Minnesota.

Cape Fear & Yadkin Valley.—A change in provisions of the reorganization plans of the Cape Fear & Yadkin Valley road is contemplated, the committee, owing to the large increase in the earnings within the last few months' having decided to modify the plan to the extent of reducing the amount of prior lien bonds to be issued under it to \$400,000, bearing interest at 4½ per cent. The mortgage will contain a provision that the bonds may be redeemed or paid off at any time, after four years, at 105 and accrued interest. For this purpose proceeds from the \$531,000 of general mortgage bonds held in reserve by the plan will be used. The committee has instructed its counsel to push forward foreclosure proceedings as quickly as possible and hopes to obtain a decree early in February.

Chicago Great Western.—During 1895, the Chicago Great Western Railway, partially filled with 69,000 cubic yards of earth its 1,271 ft. long trestle at Dodge Center, Minn., preparatory to putting in a 20 x 20 ft. stone culvert, Woods Bros., of Minneapolis, Minn., being the contractors. Twenty-five small wooden pile bridges aggregating 2,626 ft. in length were also replaced with stone culverts. The filling amounting to 105,000 cubic yards was done by Dale, Bumgardner & Shields, of St. Paul, Minn., and the culvert masonry amounting to 3,000 cubic yards was done by T. H. Houston, of Minneapolis, Minn. During the present year a number of improvements are contemplated, among which is the rebuilding of 575 lineal feet of wooden bridging across the mill races at Cedar Falls, Iowa, with medium steel plate on girders on tubular piers and stone abutments. The company will also fill up its wooden trestle at Riceville, Iowa, and put in a 14 x 14 ft. stone culvert. The trestle is 784 ft. in length and will require about 56,000 cubic yards of filling. Dale, Bumgardner & Shields, of St. Paul, Minn., has the contract for doing the work. In the laying of new track the company will extend its house track at New Hampton, Iowa, to reach the new coal, lime and cement sheds that are being erected by Bigelow Bros., and will build a spur track to Reeves' new lumber yard at Hampton.

Cleveland & Buffalo Transit Co.—At the meeting of the newly elected directors of the Cleveland & Buffalo Transit Co. held on the 7th instant, it was decided to rebuild the docks of the company at Buffalo and to otherwise put the property of the company at that port in excellent shape for the handling of the increased traffic which the new Toledo line will give the company this coming season.

Detroit, Lansing & Northern.—The board of directors of the Detroit, Lansing & Northern R. has issued a circular inviting the co-operation of holders of the road's securities in a plan of reorganization involving foreclosure of the first mortgages on the parts of the system excepting the Ionia & Lansing first mortgage. This is to be left undisturbed. The others will be purchased at foreclosure sale by the committee representing assenting bondholders. It is proposed to issue \$6,000,000 in general 4's, \$3,066,047 in preferred and \$2,510,000 in common stock, the preferred bearing interest at 5 per cent, non-cumulative. Under the proposed arrangement the annual charges will be reduced something more than \$100,000 to about \$248,000. A former plan, issued early in 1894, failed to receive the assents of a majority of the bondholders.

During the past year no road has been built by the company except the extension of the Turtle Lake branch in Benzie county from Turtle Lake to Honor, which is seven miles long, the same being an extension to reach the mill which has been located at Honor for the purpose of cutting up hardwood into veneering.

East & West.—The East & West R. Co., a new charter for which was obtained some time ago in Alabama, has now secured a new charter in Georgia. The road was recently sold under foreclosure and was then reorganized. It is about 120 miles in length and extends from Cartersville, Ga., to Pell City, Ala.

Lake Shore & Michigan Southern.—The Lake Shore railway has a large force of men engaged in building a double track from Youngstown to Doughton, a distance of five miles, and it is understood the double tracking of the entire line to Ashtabula will be carried out during the summer. All its bridges and culverts have been constructed giving ample space for a double track. The completion of

this improvement would give the Lake Shore a double track from Pittsburgh to Ashtabula via the Pittsburgh & Lake Erie. The company has also leased a five story brick building standing next to its general offices in Cleveland and will move some of its officers thereto. All departments have for some time past been badly cramped in the old quarters and the change will be a very acceptable one. The offices of the car department will be moved into commodious and pleasant quarters on the top floor of the old building.

Lima Northern.—According to the Toledo Blade Receiver J. R. McGuire, of the Ohio Southern says: "We have been pushing the work on the Lima Northern, all during the winter, and have made good progress. We have built 42 miles of track in 33 working days, and we still have 37 miles to complete the 80 mile stretch. When this is done the Ohio Southern will parallel the Cincinnati, Hamilton & Dayton, and furnish a competing line to some of the richest territory in Ohio. It will reach Toledo and Detroit and Adrian, Mich., and will be but a few miles longer than the Cincinnati, Hamilton & Dayton from Cincinnati." As has been stated the Ohio Southern will run into Toledo over the Clover Leaf, and it is hoped that the road will be in operation from Cincinnati to Toledo and Detroit by June 15.

Omaha & St. Louis.—At the recent foreclosure sale of this road which extends from Council Bluffs, Ia., to Pattonsburg, Mo., 144 miles, it was bid in at \$1,560,000 by C. B. Gold of New York, representing the bondholders, the only other bidder being W. C. Winston who is said to have represented the Wabash. The first mortgage bonds amount to \$3,312,002.76. The purchaser is required to assume the receivers indebtedness of \$240,000 on receiver's certificates due in November 1897, and claims for personal and property damages now in litigation, a total of \$255,170. There are also outstanding \$51,000 in second mortgage bonds of an issue of \$580,000, due May 1, 1940, and held by the Farmer's Loan & Trust Co. A number of companies are said to be looking out for this property but as yet no disposition of it has been made public.

San Francisco & San Joaquin Valley.—The track on the San Francisco & San Joaquin road between Stockton and Stanislaus is nearly completed and work on the bridge across the river is progressing rapidly. It is now expected that the structure will be completed within three weeks if high water does not interfere. Tracklaying will then be continued to Dry Creek and the Tuolumne, a distance of seven and ten miles. Bridges are being prepared for both points. It is hoped to have the road completed to the Tuolumne within two months. Contracts have been let for \$700,000 worth of material to be furnished during the spring and summer, enough material being in hand to complete the road to Fresno. The new contracts include steel rails, bolts, spikes, and angle plates. Another contract has been let for 150 flat cars, the company having already 100 flat cars, 80 of which are completed and in actual service. These cars will soon be required in the construction of the road, and their number will be augmented when the line is opened to traffic. The new order for flat cars will be filled by June 1. The road has also thirteen of the fifty box cars contracted for in service, as well as three water cars, provided with tanks, which are used for furnishing an additional supply to the engines. Rails are being discharged from two ships in the harbor and lumber and ties are being taken from three other vessels, and sent to Stockton and the front.

Saratoga, Mount McGregor & Lake George.—This road which is a narrow gage line extending from Saratoga to Mount McGregor, N. J., and which was built by W. J. Arkell in 1883, and operated by him since that time, has been purchased by Charles E. Arnold of Albany, N. Y., and Charles Haynes of Hudson, N. Y. The purchasers will extend the road from Wiltonville, a point about midway between Saratoga and Mount McGregor, to Glens Falls, Warren county. The work of surveying the extension was begun Tuesday. It is thought by some that the extension means an opening of the Fitchburg Railroad to reach the northern part of the state.

Southern Pacific.—The extension of the coast division of the Southern Pacific to Someo, 11 miles south of Guadalupe, is now in operation. The new terminus of the line will be called Someo, instead of Casnalina, as originally intended. Two other stations have been established on the new line. They are Waldorf, four miles south of Guadalupe, and Schumann, four miles south of Waldorf.

Texas & Pacific.—The construction work on this line, which is 7½ miles in length, was completed in December of last year and has recently been opened for traffic. The road was built under the name of Denison & Pacific Suburban, and runs from Denison to a point three miles east of Sherman.

Wisconsin & Michigan.—The Wisconsin & Michigan R. Co. recently purchased the Peshtigo Harbor R., which consists of seven miles of track and several locomotives, with docks at Peshtigo Harbor and sites for a depot and railway shops in the village of Peshtigo. The consideration is said to have been \$50,000.

NEW ROADS AND PROJECTS.

California.—The Corral Hollow R., which was projected last year to run from Stockton, Cal., to some coal mines 30 miles distant, is now to be extended to the bay, according to reports from that section. The part of the road now under construction is being built by the San Francisco & San Joaquin Coal Co., but it is said that the extension will bear the name of another corporation, and it is likely at the same time that the Santa Fe will be constructed to tap the San Joaquin Valley R. at Bakersfield. A member of the coal company is quoted as saying: "We have thus far expended about \$400,000, of which \$350,000 has gone into the railroad from Corral Hollow to Stockton. The road is broad gage and substantially built. It is not likely we should have gone to this expense merely for the purpose of transporting our coal. The distance from the mine to Oakland is less than 40 miles, and there would be no great difficulty in obtaining the rights-of-way. There have been two propositions suggested. One is to tunnel through the hills to Livermore, and the other to pass through the Cor-

ral-Hollow canon. I won't say, however, that the project has been decided upon."

At a meeting of the proposed Mill Valley & Tamalpas Scenic Railroad shareholders recently held at San Francisco, officers were elected as follows: Sidney B. Cushing, president; David McKay, vice president; Louis L. Janes, secretary, and the First National Bank of San Francisco, treasurer. The road, which is to be 8 miles in length, has already been surveyed and is to be located on the Cushing tract in Mill valley, between the Blithedale hotel and the Eastland station. All the material and rolling stock used will be purchased in that state, and of California manufacture where possible. The California Construction Co. has secured the contract to do the grading, and a large force of men was put to work this week. Contracts are about to be let for engines, boilers, dynamos and other requisites for generating power. Work will also begin on a power house at once. The terminus of the road will be Eastland station. The idea of purchasing the O'Shaughnessy tract near Eastland station and building a large depot has been given up. Capital stock, \$200,000.

Colorado.—Articles of incorporation for another Cripple Creek road have been filed in Colorado with a capital stock of \$1,000,000. It is the purpose of this company to construct a direct line of railroad from Denver to Cripple Creek. The road will probably be run by electric power, although the details have not yet been perfected. The name is to be the South Platte Railroad & Power Co., and the incorporators are S. L. Smith, J. E. Rockwell, Norman Allen, George F. Dayton and J. H. Dayton.

Florida.—Surveys have been made for an extension of the short branch line of the Florida Southern R., now running from Citra, on the Florida Central & Peninsular, to Orange Lake. The extension will be from the latter point through the northwestern part of that county, and will probably go to or beyond Flemington, crossing the road now under construction from Micanopy southward toward Ocala. With the building of these branch lines will be opened up one of the finest bodies of virgin hammock land in the world and the territory embraced in the scheme is very fine farming lands. The construction or extension of these lines has renewed the rumor that an effort will be made eventually to make a new county from the western part of Marion and the southeastern part of Alachua, with Micanopy as the county seat.

Georgia.—Reports from the south say that the new road which is to run from Valdosta, Ga., south into Florida to connect with the Florida Central & Peninsular, has recently received great impetus and the citizens of that vicinity are looking forward to better times. Col. J. M. Wilkinson, president of the Valdosta Southern, has contracted for six miles of new steel rails, which will put the road well into Florida and in close distance of Madison. It is said that financial arrangements have been made for the completion of the line. The new road will open a vast and splendid territory, and give a new competing line that will probably lighten freight on the merchants there. Col. Wilkinson will continue to push his road on into Florida. That part of it which has been under operation is in fine condition and paying handsomely.

Idaho.—On Feb. 10 a company was incorporated at Boise, Idaho, for the purpose of building railroads to connect this city with the great gold camps of Owyhee county. It is said that the company is capitalized for \$1,000,000, which represents cost of road, and that arrangements have already been made to float bonds for the entire system. Work will be commenced at once. The enterprise is the most important ever undertaken in Idaho. Congressman Wilson is president of the new company.

Illinois.—Mr. N. R. Olcott, chief engineer of the recently organized Chicago & Southern Illinois R., has this week started a survey from St. Elmo, Ill., to Shelbyville, a distance of 80 miles, thus making a connection with the Chicago & Eastern Illinois and Chicago, Paducah & Memphis. The new company expects to commence work as soon as the surveys are completed. The address of Mr. Olcott, chief engineer, is St. Elmo, Ill.

A project to build an electric road between Quincy and Niota, Ill., is being talked up by Mr. James Harrington, attorney, in the interests of Mr. J. C. Hubinger of Keokuk, so it is said. The line is to be 60 miles long and would connect with the Santa Fe at Niota, which is opposite Fort Madison, Ia. It is thought by the business men of Quincy that material benefits would be conferred upon that place by the building of such a road, which would be essentially a Quincy road, and in which city all the shops would be located, with a guaranteed employment of many men. Mr. Hubinger would ask of Quincy free terminal grounds, including rights of way, the exemption from taxation and private assistance to the amount of \$75,000, for which amount stock would be given subscribers. The total cost of the road will be \$750,000.

Maryland.—About one-half the grading on the first section of the Queen Anne's road is completed and it is expected that this section, which is 20 miles in length and extends from Queenstown to Denton, Md., will be in operation within 90 days. The contractors are pushing the work with all possible haste and the wharves at Queenstown have been completed. These wharves are said to be the strongest on Chesapeake bay and are capable of accommodating three trains. The contract for building the second section will be awarded within the next 15 days. The route has already been graded and is ready for tracklaying.

Mexico.—The total length of the proposed Gulf, Rio Grande & Pacific road will be over 1,000 miles. Lines are to connect the town of Trevino at the terminus of the Monterey & Mexican Gulf with some point on the Pacific, and to run a line to the United States from the city of Laredo. Completion of these roads will give an impetus to business of Mexico. Companies under the name of the Rio Grande Improvement & Construction Co. will be organized to build the lines. The capital of the company will be \$80,000,000 silver, and the headquarters of the company will probably be in Cleveland, Ohio. It is proposed to complete 250 miles between Trevino and Emetrio La Garza this year.

The work of constructing a railroad from Guaymas to Cocori, in the heart of the Yaqui Indian country, will begin as soon as the material can be obtained. The road will be 120 kilometers long, and will pass through a section of

country rich in mineral and agricultural resources. The concession for the road is owned by Thomas A. Rask. The federal government agrees to donate \$2,000 worth of land for each kilometer of road constructed.

Missouri.—St. Louis dispatches say that a new line from St. Louis to the southwest is likely to be the result of the contemplated separation of the Frisco from the Santa Fe system. E. H. R. Green, president of the Texas Midland is quoted as saying that in event of the separation of the two roads he was prepared to engage in the construction of certain branch and auxiliary lines which would give St. Louis an entrance into central Texas by a route many miles shorter than that which it now enjoys. From St. Louis to Paris, Tex., the San Francisco line runs in a line which is more direct than any other route. From Paris to Greenville there is a gap that President Green proposes to fill. From Greenville to Ennis the Texas Midland is already in operation, and between Ennis and Waco there is also a gap of 65 miles, which President Green is ready to build upon receipt of notice that the San Francisco will begin to operate its road upon an independent basis. To Dallas from Quinlan, a point on the Texas Midland, there is only an unfilled space of something like 62 miles, and this will be built by Mr. Green and persons whom he represents. Between Dallas and Fort Worth there is only a little gap to be filled to make the new line complete.

Feb. 21 is the day set for a meeting of the officials and projectors of the Missouri Midland at Marshall, Mo., for the purpose of ascertaining the attitude of Saline county in regard to the enterprise. The work is to begin at Marshall, go through the great coal fields 12 miles south of that place, and on through Sedalia to Springfield. The men in charge are abundantly able to push the road to rapid completion, and if Marshall will give them encouragement work will commence immediately. It is thought that the general feeling in the community is in favor of building the road.

It is stated that officials of the Missouri Pacific are talking strongly of building during the coming summer, a short line between Jefferson City and Booneville, along the south bank of the river, to connect at Booneville with the Booneville & Lexington division, thus making the shortest route between St. Louis and Kansas City by 30 miles. The road is projected for use principally as a heavy freight line, the grade averaging only 14 feet to the mile between those two points. If this is done and the Missouri Midland road built, Marshall will begin to loom up as quite a railroad center.

In an interview Dr. Griffin Gunn, president of the projected Oklahoma, St. Louis & Texas Air Line, is quoted as saying: "The road is regarded as one of the most important of recent projections in the southwest. It will give to St. Louis a direct line to Oklahoma City. Two hundred men and teams are now grading and cutting ties. The main line runs southwest through the Choctaw Nation to Alabama, Texas, and a branch road to Oklahoma City. The bonds are already pledged by two parties. It will open up a fine country for St. Louis. It is the intention to build a great school at some point on the line, partly for the benefit of the children of the employees of the road. It will be called the 'Trades Military College.'" President Gunn has built a number of Episcopal churches, also the Wilder college in Minnesota and the Holland hospital in Idaho.

New York.—A road nearly 30 miles in length is to be built between Genesee, Pa., and Hornellsville, N. Y., and will be called the New York & Pennsylvania. It is stated that this will be built as an independent line but will virtually be an extension of the Olean, Oswego & Eastern.

Oklahoma.—The manager of the Hutchinson, Oklahoma & Guthrie R. is said to have confirmed the report that the company has decided on building on the old route to Guthrie and from Guthrie southeast to Chandler and the straight south line into Texas. It is also added that work will begin April 1, the contract for iron having been already let.

Pennsylvania.—A company was recently incorporated in Pennsylvania under the name of Millersburg & Brookside to construct a line 23 miles in length in Dauphin and Schuylkill counties from a connection with the Northern Central at Millersburg to a point near Brookside. The directors of the new road are as follows: John A. Barry, A. J. Country, H. T. Wilkins, R. M. Williams and Alfred C. Heston, Philadelphia, and H. P. Connor, Radnor. Mr. Wm. P. Schofield of Camden, N. J., is president. When built, the new road will become a part of the Pennsylvania railroad system and will be parallel for some distance with the Lykins Valley branch. Capital stock, \$230,000.

The Wilkesbarre & Northern R. Co., has been incorporated in Pennsylvania to build a road 15 miles in length, extending from the city of Wilkesbarre to the outlet of Harveys Lake, all within Luzerne county. The stockholders are John B. Reynolds and P. B. Reynolds of Kingston, Alexander Farnham, Andrew Hunlock, Chas. D. Foster and E. Troxell of Wilkesbarre, and C. D. Honeyville and C. A. Spencer of Dallas, Pa. John B. Reynolds is president and the principal offices are at Wilkesbarre. Capital stock, \$200,000.

Grading on the Buffalo & St. Mary's from St. Mary's to Clermont, about 25 miles, is practically finished and track laying will soon begin. The track will be laid with 75 lb. rails and metal tie plates will be used. The object of the road is to extend the St. Mary's & Southwestern to a connection with the Western New York & Pennsylvania at Clermont, affording a direct outlet for the large body of coal south of St. Mary's in the vicinity of Toby Valley, owned by capitalists of St. Mary's and Ridgeway. It is also stated that the line will be extended to a connection with the Erie near Mount Jewett in the near future.

There has been filed in the state department at Harrisburg, Pa., the papers relating to the reorganization of the Southern Central R. Co. This company was reorganized Feb. 1 at Harrisburg, Pa., with a capital stock of \$3,000,000 to build a line 52 miles long from Harrisburg to Sunbury. The directors of the new company are S. P. Wolverton, Sunbury; S. J. M. McCarrell, Harrisburg; Joseph L. Tull, Alfred Gratz, Henry M. Gratz, and Vincent McLaughlin, all of Philadelphia. Franklin McLaughlin of Philadelphia is president and Joseph L. Tull of the same place is treasurer. The new corporation purchased the franchises of the old Southern Central last November at

sheriff's sale. Most of the rights of way have been secured, especially the important stretch through the Rockville narrows of the Susquehanna River.

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—It is stated that G. L. Maloney, J. York, and L. D. Johnson, of Nashville, Tenn., have been appointed a committee by the county court to report on the proposed stone or steel bridge, 2,000 ft. long, over the Tennessee river at that city. It is probable that bids will soon be asked for its construction, which is estimated to cost \$725,000.

—The Berlin Iron Bridge Company, has just completed a very successful year with shipments the largest in the history of the company, and representing over \$1,000,000 worth of business. At the annual meeting of the stockholders, on January 30, the following directors were elected: C. M. Jarvis, Burr K. Field, G. H. Sage, H. H. Peck, of Waterbury; S. H. Wilcox, of Brooklyn, N. Y.; J. W. Burr and F. L. Wilcox. The following officers were elected: President and Chief Engineer, Charles M. Jarvis; vice president, B. K. Field; secretary, G. H. Sage; treasurer, F. L. Wilcox; manager of highway bridge department D. E. Bradley; assistant of the president, E. W. Stearns.

—The following bills were introduced in congress on January 24 to approve and ratify construction of a bridge across Caddo Lake at Moorsport, La., by the Kansas City, Shreveport & Gulf; bridge over Sulphur river, Ark., by the Texarkana & Fort Smith; bridge across Red River, between Arkansas and Texas, near Fulton, Ark., by the Texarkana Northern, now operated by the Texarkana & Fort Smith; authorizing the Kansas City, Watkins & Gulf to construct and maintain a bridge across Black River, in Louisiana, and across Red River at Alexandria, La.

—The Pittsburgh & Lake Erie is reported as contemplating the erection of a bridge near New Castle to reach the new works recently erected in Mahoningtown borough.

—The East river bridge commission, which met Jan. 30, adopted a resolution endorsing the report of the chief engineer recommending six tracks for trolley lines and elevated roads, as follows: "Resolved, That we construct a bridge, not exceeding 118 ft. wide, with six tracks thereon, two for the elevated railroad service and four for the surface railroad service with all the necessary approaches and switches and terminals—all tracks to be on the same level at the center of said bridge, and to build a promenade for pedestrians over said tracks. The approaches and tracks to be constructed so as to provide equally without discrimination for the railroad passenger service in both cities, and that the chief engineer be instructed to forthwith prepare plans accordingly. It has been determined that \$500,000 will be sufficient for the preliminary work to be done this year, and that amount Mayor Strong and Mayor Wurster have agreed shall be appropriated, each city paying \$250,000.

—The Ontario government has been petitioned to grant a subsidy of \$250,000 toward the construction of a bridge at Nepean Point, Ontario. It is stated that Ottawa has voted \$150,000 toward the project, and that Quebec and Ontario have granted \$50,000 each.

—The council of New Westminster, B. C., is reported as again considering the question of constructing a bridge over the Fraser river. The provincial government has made an appropriation of \$126,000, and the Dominion government will be petitioned to appropriate \$100,000 to aid in the construction of the structure.

—Bids for the construction of a combined railway and highway bridge, with 5 ft. sidewalk, were received by the Tallassee & Montgomery Railway Co., W. G. Williamson, chief engineer, Jan. 25, as follows, the bridge to have two spans, plate girders, 50 ft. 9 in. each; two spans, plate girders, 55 ft. each; one span, pin truss, 103 ft.; one span, pin truss, 183 ft.:

	Metal Work	Delivered. Erection
George H. Crafts	- - - - -	\$18,000 \$4,800
Pittsburgh Bridge Co.	- - - - -	16,200 . . .
Gude & Walker	- - - - -	15,200 5,900
Union Bridge Co.	- - - - -	13,778 5,722
Edgemoore Bridge Works	- - - - -	12,534 5,553
Watkins & Hardaway	- - - - -	13,250 3,750

—The following bids were received January 25 for constructing the superstructure for a bridge over Mahoning river.

Massillon Bridge Co., Massillon, O.	- - - - -	\$38,225
Wrought Iron Bridge Co., Canton, O.	- - - - -	37,960
Penn Bridge Co., Beaver Falls, Pa.	- - - - -	39,625
King Bridge Co., Cleveland, O.	- - - - -	54,760
Toledo Bridge Co., Toledo, O.	- - - - -	\$27,000 and 30,950
Pittsburgh Bridge Co., Pittsburgh, Pa.	- - - - -	42,650
Groton Bridge & Mfg. Groton, N. Y.	- - - - -	\$53,600 and 51,500
Variety Iron Works Co., Cleveland, O.	- - - - -	32,960
Champion Bridge Co., Wilmington, O.	- - - - -	49,650
Youngstown Bridge Co., Ygst'wn, O.	- - - - -	\$17,550 and 35,326

—The Youngstown (O.) Bridge Company recently shipped two large girders for the C. A. & C. road. Each girder is 91 ft. long and 9 ft. wide. They are riveted together and 9 ft. across the top. The weight of both girders is about 40 tons.

—The material for the second section of the Boston subway comprising about 1000 tons of structural material, mostly T beams is being shipped by the Pennsylvania Street Company. The Company has recently received a contract for 1,500 tons of T rails from the Cumberland Valley Railroad Company.

Buildings.

—The contract for building a large freight depot at Pinners Point, Va., for the Southern Railway has been awarded to Wilson & Seay of Lynchburg, Va. The building will be 188x702 feet.

—Work has been begun on the new depot of the Carolina Central (Seaboard Air Line system) at Charlotte, N. C.

—The erection of the new station buildings at Greensboro, Durham, Selma, N. C., and some other stations on

the Southern Railway's new route to Norfolk, Va., will probably be now soon begun, as the suit to annul the lease of the North Carolina Railroad (on which these stations are located) to the Southern has been withdrawn.

—The New York Central Railroad is to build a one-story freight house, at Buffalo, on the south side of Carroll street between Michigan and Chicago streets. The frontage will be 50x880 ft. William J. Gillett, of Syracuse, has the contract for the building.

—Plans have been filed with the department of buildings by the New York Central Railroad for a one-story iron passenger station to be erected at Railroad avenue, between 138th and 139th streets, New York city, to cost about \$50,000. It will be an elevated structure, and will form part of the great Park avenue improvement now approaching completion. If the Mott Haven station is actually abandoned, this new station will be the nearest station for the Mott Haven passengers.

—It is reported that the Southern Ry. Co. will establish machine shops at Salisbury, N. C. New brick buildings will be erected and equipped with new machinery throughout, including electric light plant.

—The Bush Co., with offices at 44 Pine street, New York city, is reported as about to erect a grain elevator of 2,000,000 bu capacity, to be located at Forty-second street, Brooklyn, N. Y.

—The Newport (Ky.) Rolling Mill Company has awarded contracts for the erection of cold roll mills, modern sheet mills, etc. The company expects to have the mills ready by July 1. They will have a capacity of 125 tons per week.

—The Enterprise Foundry Co., of Muskegon, Mich., is erecting a new foundry. The main building will be 50x100 feet; large core room with core oven 10x10x30 feet; cupola room with a 54-inch cupola; also chipping room, shipping room, pattern storage room and office. All the buildings are of white pressed brick with corrugated iron roof and it is expected it will be one of the most modern foundry plants in the country when completed.

—A report states that the sum of \$100,000 has been voted by London, Ont., to the Grand Trunk Railroad as an inducement to build car shops there which will give employment to 300 men.

—The Punxsutawney (Pa.) Iron Company is now having plans made for the erection of a coke blast furnace. At present the company is figuring on an 80 by 18-foot furnace, to be equipped with three 80 by 18-foot Cowper-Kennedy stoves. The plans may, however, be modified a little and a 76 by 17½-foot furnace erected. The furnace will probably have an annual capacity of from 75,000 to 85,000 gross tons. The company expects to begin active work on the foundations of the plant shortly, and hopes to have the stack completed and ready for blast not later than next fall.

—The Keystone Axle Company, formerly of Baltimore, Md., which has decided to locate at Beaver Falls, Pa., has awarded a contract to Moffitt & Son for the foundation of its building, and to the Penn Bridge Company of Beaver Falls, Pa., for the building itself. It will be of steel frame construction, covered with iron, and will be 80x200 feet in size. The company is now considering proposals for the engines and boilers.

Cars and Locomotives.

—It is currently reported that the Ohio river railroad is soon to be in the market for 300 freight cars.

—The New York Central let contracts for 2,200 cars Thursday, 500 of these were taken by the Union Car Company and the remainder are divided between the Buffalo Car Company and the Barney & Smith Car Company. Of the total, 1,500 are coal, 500 flat and 250 stock cars.

—The Pennsylvania Lines said to be preparing to order 1,000 freight cars.

—It is reported that the Erie Railway has placed orders for 2,250 cars, 2,000 being gondolas and 250 hopper bottom coal cars. The Michigan Peninsular Car Co., secured an order for 1,500 and the Union Car Co., Buffalo, 750.

—The Lake Shore & Michigan Southern Railway last week let contracts for the building of 2,100 new freight cars. The orders were divided as follows: Michigan Peninsular Car Works, 500 box and 500 coal cars; Madison Car Works, 250 box and 250 coal cars; Union Car Works, 250 coal and 100 box cars; the Wells & French Co., 250 box cars. One hundred of the cars will be equipped with the Fox pressed steel truck and the remainder will have the Schoen pressed steel bolster. The box cars will all have iron axles in accordance with the usual practice of the Lake Shore road but this practice will be departed from in the coal cars and steel axles used.

—It is understood that the Duluth, Missabe & Northern Railroad has increased its order for ore cars to be built by the Pullman Company from 400 to 600.

—The rumor that the Cleveland, Lorain & Wheeling Railroad is to be in the market for some new freight cars is authoritatively denied.

—The Wells & French Co. has an order for 400 ore cars for the Lake Shore & Ishpeming Railroad (Iron Cliffs Co., Ishpeming, Mich.)

—The new private car built for President D. W. Caldwell, of the Lake Shore road, by the Wagner Company has been delivered to that company.

—The Kalamazoo Railroad Velocipede & Car Co., shipped last month one each No. 9 "Special" steam inspection car and two horse power gasoline motor car to Australia. They ship this week one eight horse power motor car to Mississippi and one No. 9 "Special" steam inspection car to Buenos Ayres, South America.

Machinery and Tools.

—A large order for hoisting machinery has been placed by Willis Shaw, 416 New York Life Building, Chicago, with the Pen Argyle Iron Works of Pen Argyle, Pa., for early March delivery. The order includes 12 engines, with the boilers and necessary equipments. The hoists will be used in the construction of the retaining wall of the Chicago drainage canal.

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—A 160-foot iron or steel bridge will be erected over Mahantongo Creek, near Uniontown, Pa., by the joint commissioners of Northumberland and Dauphin counties.

—It is stated that G. L. Maloney, J. York, and L. D. Johnson, of Nashville, Tenn., have been appointed a committee by the county court to report on the proposed stone or steel bridge, 2,000 ft. long, over the Tennessee river at that city. It is probable that bids will soon be asked for its construction, which is estimated to cost \$725,000.

—The Berlin Iron Bridge Company, has just completed a very successful year with shipments the largest in the history of the company, and representing over \$1,000,000 worth of business. At the annual meeting of the stockholders, on January 30, the following directors were elected: C. M. Jarvis, Burr K. Field, G. H. Sage, H. H. Peck, of Waterbury; S. H. Wilcox, of Brooklyn, N. Y.; J. W. Burr and F. L. Wilcox. The following officers were elected: President and Chief Engineer, Charles M. Jarvis; vice president, B. K. Field; secretary, G. H. Sage; treasurer, F. L. Wilcox; manager of highway bridge department D. E. Bradley; assistant of the president, E. W. Stearns.

—The following bills were introduced in congress on January 24 to approve and ratify construction of a bridge across Caddo Lake at Moovensport, La., by the Kansas City, Shreveport & Gulf; bridge over Sulphur river, Ark., by the Texarkana & Fort Smith; bridge across Red River, between Arkansas and Texas, near Fulton, Ark., by the Texarkana Northern, now operated by the Texarkana & Fort Smith; authorizing the Kansas City, Watkins & Gulf to construct and maintain a bridge across Black River, in Louisiana, and across Red River at Alexandria, La.

—The Pittsburgh & Lake Erie is reported as contemplating the erection of a bridge near New Castle to reach the new works recently erected in Mahoningtown borough.

—The East river bridge commission, which met Jan. 30, adopted a resolution endorsing the report of the chief engineer recommending six tracks for trolley lines and elevated roads, as follows: "Resolved, That we construct a bridge, not exceeding 118 ft. wide, with six tracks thereon, two for the elevated railroad service and four for the surface railroad service with all the necessary approaches and switches and terminals—all tracks to be on the same level at the center of said bridge, and to build a promenade for pedestrians over said tracks. The approaches and tracks to be constructed so as to provide equally without discrimination for the railroad passenger service in both cities, and that the chief engineer be instructed to forthwith prepare plans accordingly. It has been determined that \$500,000 will be sufficient for the preliminary work to be done this year, and that amount Mayor Strong and Mayor Wurster have agreed shall be appropriated, each city paying \$250,000.

—The Ontario government has been petitioned to grant a subsidy of \$250,000 toward the construction of a bridge at Nepean Point, Ontario. It is stated that Ottawa has voted \$150,000 toward the project, and that Quebec and Ontario have granted \$50,000 each.

—The council of New Westminster, B. C., is reported as again considering the question of constructing a bridge over the Fraser river. The provincial government has made an appropriation of \$126,000, and the Dominion government will be petitioned to appropriate \$100,000 to aid in the construction of the structure.

—Bids for the construction of a combined railway and highway bridge, with 5 ft. sidewalk, were received by the Tallassee & Montgomery Railway Co., W. G. Williamson, chief engineer, Jan. 25, as follows, the bridge to have two spans, plate girders, 50 ft. 9 in. each; two spans, plate girders, 55 ft. each; one span, pin truss, 103 ft.; one span, pin truss, 183 ft.:

	Metal Work	Delivered. Erection
George H. Crafts	- - - - -	\$18,000 \$4,800
Pittsburgh Bridge Co.	- - - - -	16,200 . . .
Gude & Walker	- - - - -	15,200 5,900
Union Bridge Co.	- - - - -	13,778 5,722
Edgemoore Bridge Works	- - - - -	12,534 5,553
Watkins & Hardaway	- - - - -	13,250 3,750

—The following bids were received January 25 for constructing the superstructure for a bridge over Mahoning river.

Massillon Bridge Co., Massillon, O.	- - - - -	\$38,225
Wrought Iron Bridge Co., Canton, O.	- - - - -	37,960
Penn Bridge Co., Beaver Falls, Pa.	- - - - -	39,625
King Bridge Co., Cleveland, O.	- - - - -	54,760
Toledo Bridge Co., Toledo, O.	- - - - -	\$27,000 and 30,950
Pittsburgh Bridge Co., Pittsburgh, Pa.	- - - - -	42,650
Groton Bridge & Mfg. Groton, N. Y.	- - - - -	\$53,600 and 51,500
Variety Iron Works Co., Cleveland, O.	- - - - -	32,960
Champion Bridge Co., Wilmington, O.	- - - - -	49,650
Youngstown Bridge Co., Ygst'wn, O.	- - - - -	\$17,550 and 35,326

—The Youngstown (O.) Bridge Company recently shipped two large girders for the C. A. & C. road. Each girder is 91 ft. long and 9 ft. wide. They are riveted together and 9 ft. across the top. The weight of both girders is about 40 tons.

—The material for the second section of the Boston subway comprising about 1000 tons of structural material, mostly T beams is being shipped by the Pennsylvania Street Company. The Company has recently received a contract for 1,500 tons of T rails from the Cumberland Valley Railroad Company.

Buildings.

—The contract for building a large freight depot at Pinners Point, Va., for the Southern Railway has been awarded to Wilson & Seay of Lynchburg, Va. The building will be 188x702 feet.

—Work has been begun on the new depot of the Carolina Central (Seaboard Air Line system) at Charlotte, N. C.

—The erection of the new station buildings at Greensboro, Durham, Selma, N. C., and some other stations on

the Southern Railway's new route to Norfolk, Va., will probably be now soon begun, as the suit to annul the lease of the North Carolina Railroad (on which these stations are located) to the Southern has been withdrawn.

—The New York Central Railroad is to build a one-story freight house, at Buffalo, on the south side of Carroll street between Michigan and Chicago streets. The frontage will be 50x880 ft. William J. Gillett, of Syracuse, has the contract for the building.

—Plans have been filed with the department of buildings by the New York Central Railroad for a one-story iron passenger station to be erected at Railroad avenue, between 138th and 139th streets, New York city, to cost about \$50,000. It will be an elevated structure, and will form part of the great Park avenue improvement now approaching completion. If the Mott Haven station is actually abandoned, this new station will be the nearest station for the Mott Haven passengers.

—It is reported that the Southern Ry. Co. will establish machine shops at Salisbury, N. C. New brick buildings will be erected and equipped with new machinery throughout, including electric light plant.

—The Bush Co., with offices at 44 Pine street, New York city, is reported as about to erect a grain elevator of 2,000,000 bu capacity, to be located at Forty-second street, Brooklyn, N. Y.

—The Newport (Ky.) Rolling Mill Company has awarded contracts for the erection of cold roll mills, modern sheet mills, etc. The company expects to have the mills ready by July 1. They will have a capacity of 125 tons per week.

—The Enterprise Foundry Co., of Muskegon, Mich., is erecting a new foundry. The main building will be 50x100 feet; large core room with core oven 10x10x30 feet; cupola room with a 54-inch cupola; also chipping room, shipping room, pattern storage room and office. All the buildings are of white pressed brick with corrugated iron roof and it is expected it will be one of the most modern foundry plants in the country when completed.

—A report states that the sum of \$100,000 has been voted by London, Ont., to the Grand Trunk Railroad as an inducement to build car shops there which will give employment to 300 men.

—The Punxsutawney (Pa.) Iron Company is now having plans made for the erection of a coke blast furnace. At present the company is figuring on an 80 by 18-foot furnace, to be equipped with three 80 by 18-foot Cowper-Kennedy stoves. The plans may, however, be modified a little and a 76 by 17½-foot furnace erected. The furnace will probably have an annual capacity of from 75,000 to 85,000 gross tons. The company expects to begin active work on the foundations of the plant shortly, and hopes to have the stack completed and ready for blast not later than next fall.

—The Keystone Axle Company, formerly of Baltimore, Md., which has decided to locate at Beaver Falls, Pa., has awarded a contract to Moffitt & Son for the foundation of its building, and to the Penn Bridge Company of Beaver Falls, Pa., for the building itself. It will be of steel frame construction, covered with iron, and will be 80x200 feet in size. The company is now considering proposals for the engines and boilers.

Cars and Locomotives.

—It is currently reported that the Ohio river railroad is soon to be in the market for 300 freight cars.

—The New York Central let contracts for 2,200 cars Thursday, 500 of these were taken by the Union Car Company and the remainder are divided between the Buffalo Car Company and the Barney & Smith Car Company. Of the total, 1,500 are coal, 500 flat and 250 stock cars.

—The Pennsylvania Lines said to be preparing to order 1,000 freight cars.

—It is reported that the Erie Railway has placed orders for 2,250 cars, 2,000 being gondolas and 250 hopper bottom coal cars. The Michigan Peninsular Car Co., secured an order for 1,500 and the Union Car Co., Buffalo, 750.

—The Lake Shore & Michigan Southern Railway last week let contracts for the building of 2,100 new freight cars. The orders were divided as follows: Michigan Peninsular Car Works, 500 box and 500 coal cars; Madison Car Works, 250 box and 250 coal cars; Union Car Works, 250 coal and 100 box cars; the Wells & French Co., 250 box cars. One hundred of the cars will be equipped with the Fox pressed steel truck and the remainder will have the Schoen pressed steel bolster. The box cars will all have iron axles in accordance with the usual practice of the Lake Shore road but this practice will be departed from in the coal cars and steel axles used.

—It is understood that the Duluth, Missabe & Northern Railroad has increased its order for ore cars to be built by the Pullman Company from 400 to 600.

—The rumor that the Cleveland, Lorain & Wheeling Railroad is to be in the market for some new freight cars is authoritatively denied.

—The Wells & French Co. has an order for 400 ore cars for the Lake Shore & Ishpeming Railroad (Iron Cliffs Co., Ishpeming, Mich.)

—The new private car built for President D. W. Caldwell, of the Lake Shore road, by the Wagner Company has been delivered to that company.

—The Kalamazoo Railroad Velocipede & Car Co., shipped last month one each No. 9 "Special" steam inspection car and two horse power gasoline motor car to Australia. They ship this week one eight horse power motor car to Mississippi and one No. 9 "Special" steam inspection car to Buenos Ayres, South America.

Machinery and Tools.

—A large order for hoisting machinery has been placed by Willis Shaw, 416 New York Life Building, Chicago, with the Pen Argyle Iron Works of Pen Argyle, Pa., for early March delivery. The order includes 12 engines, with the boilers and necessary equipments. The hoists will be used in the construction of the retaining wall of the Chicago drainage canal.